

GENERAL LIBRARY,
UNIV. OF MICH.
FEB 9 1906

SCIENTIFIC AMERICAN

(Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1905, by Munn & Co.)

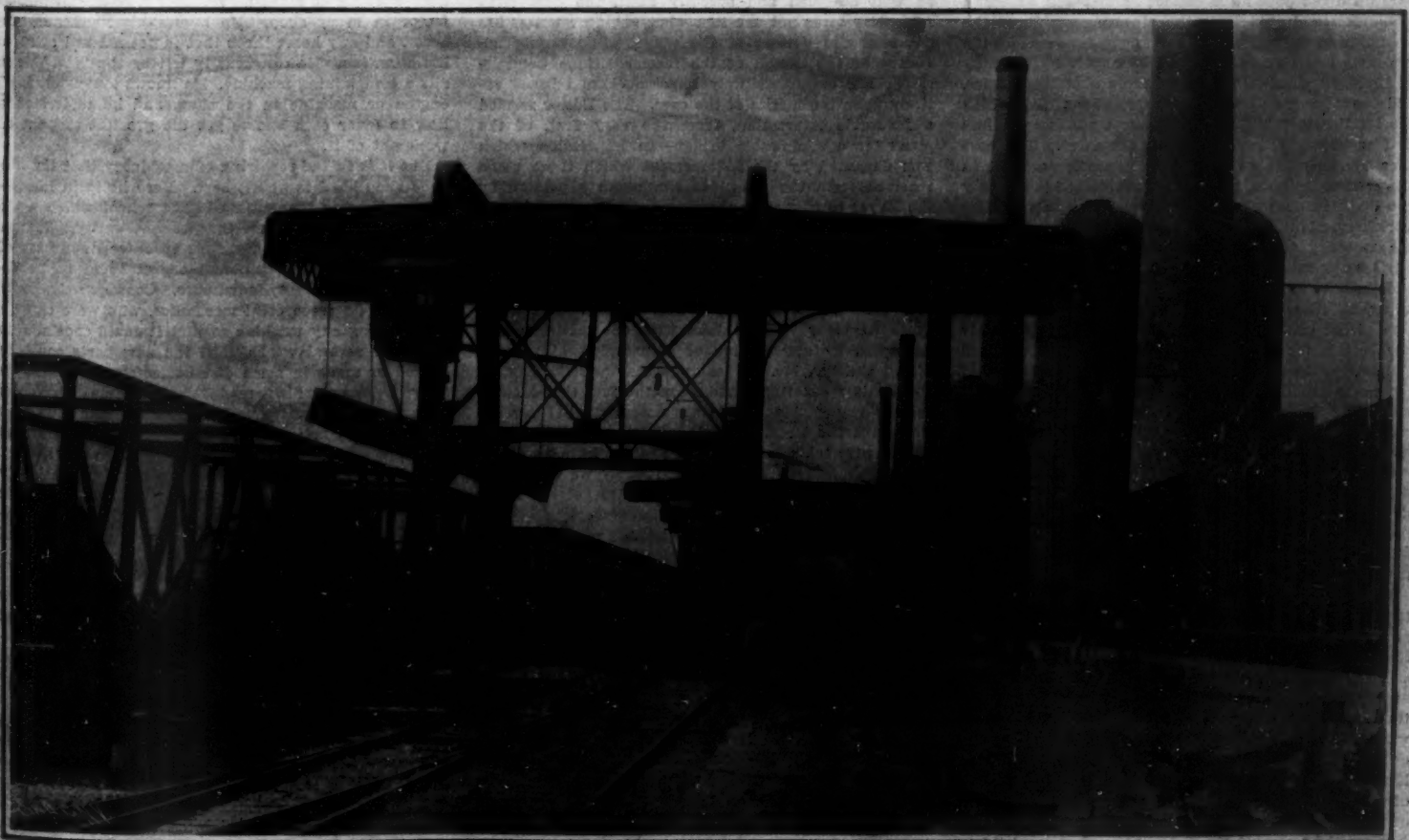
Vol. XCIV.—No. 6.
ESTABLISHED 1845.

NEW YORK, FEBRUARY 10, 1906.

[10 CENTS A COPY.
\$3.00 A YEAR.]



At the Ore-Unloading Docks of Conneaut, Ohio.



An Electrical Crane of Twenty Tons Capacity Which Handles Only Coke.

ORE-UNLOADING BY MACHINERY. [See page 181.]

SCIENTIFIC AMERICAN

ESTABLISHED 1843

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico, \$3.00
 One copy, one year, to any foreign country, postage prepaid, \$6.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.
 Scientific American (Established 1843) \$3.00 a year
 Scientific American Supplement (Established 1876) 5.00
 American Homes and Gardens 3.00
 Scientific American Export Edition (Established 1899) 4.00
 The combined subscription rates and rates to foreign countries will be furnished upon application.
 Remit by postal or express money order, or by bank draft or check.
 MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, FEBRUARY 10, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

STATE COMMISSION ON NEW YORK WATER SUPPLY.

According to its first annual report to the Legislature, the New York State Water Supply Commission has been occupied chiefly in considering the needs of New York city for an increased water supply. The application for permission to establish a water system in the Catskill region at a cost of \$160,000,000 is the most important problem of its kind yet proposed in this country. The report says that, judging from the statement of eminent engineers, it seems altogether probable that New York city must eventually utilize the waters of the Hudson River, either directly from its source in the Adirondacks, or possibly at less cost near Poughkeepsie, at a point on the Hudson about 75 miles distant from the city. Attention is drawn to the movement for the purification and protection of streams and rivers, which has been carried out with such success in Europe, that it seems likely to have the ultimate beneficial result of abolishing the barbarous plan of making scavengers of fresh-water streams.

The plan for establishing a water system in the Catskill regions has provoked the inevitable opposition, which occurs when any inhabited, and more or less cultivated, watershed is appropriated for city water supply. The formation of the extensive reservoirs will mean the absolute flooding out of inhabited districts, and the removal of buildings and abolition of farms from a belt of land bordering on each side of the tributaries to the main reservoir. That the occupation of a watershed in this way works positive hardship upon the population cannot be disputed, although we understand that it is the sincere purpose of the Commission to make adequate compensation to the residents and owners who will be affected. To many of these, no doubt, the loss of their ancestral homes, and the wiping out of all the associations with which the locality is enriched, will mean a sentimental loss that monetary compensation cannot meet. The case thus becomes one of conflicting interests; and if, in the present instance, the Catskill watershed is the only one that can properly meet the pressing needs of New York city, stern necessity will compel the sacrifice of the minority to the imperative needs of New York city's many million inhabitants.

Although the Catskill scheme has been recommended, and all things considered, presenting the best solution of the problem, it is not by any means the only one that has been under discussion, or has received eminent professional indorsement. As the report of the State Commission suggests, New York city must ultimately be driven to the Hudson River as its main source of water supply. One Engineering Commission has suggested that the Hudson River water should be used in preference to that of the Catskills, either by bringing it direct from its sources in an aqueduct, or by building a pumping plant on the river, and raising the water to a system of filtering beds, located on the hills back of the river, whence it would flow by gravity to the reservoirs within the city limits.

In this connection we publish on another page a letter from a correspondent, who offers the very novel and striking proposal to impound the waters of the Hudson River in various reservoirs located near its sources; build at each site a hydraulic-electric plant; and transmit the current to an electrical pumping station at Poughkeepsie, where the Hudson River water would be raised to the filtration beds and reservoirs on the hills above. The scheme, if based on the Burr, Hering, Freeman estimate, would involve the raising of 500,000,000 gallons daily through a vertical height of 400 feet. Our correspondent believes that his project could be carried through with a saving of thirty per cent, as compared with the scheme of providing a dam at Ashokan and an aqueduct for conveying the water from the dam to a reservoir on the Poughkeepsie side of the river. As regards the project suggested by our correspondent, it must be remembered that for the performance of this work by the hydraulic-electric

method, there must be provided, at the many power plants scattered through the Adirondacks, the energy represented by the fall of 500,000,000 gallons daily through a height of 400 feet, plus the power necessary to overcome the resistance in the pipe lines, in the turbines, in the generators, and in the step-up transformers. To this must be added the energy necessary to overcome the resistance in the hundreds of miles of transmission line between the Adirondack power stations and the pumping plant at Poughkeepsie, and also the resistance in the pumping plant itself due to the step-down transformers, the rotary converters, the motors, the pumps, and the pipe lines, from the intake at the Hudson to the outlet at the reservoir on the hills above. It would be an interesting problem, when the location of the power plants was established, to determine how many hundreds of millions of gallons must be delivered daily to the turbines, to cover the above-enumerated sources of loss, and still suffice for the stupendous and unending effort of lifting the 500,000,000 gallons daily to a height of 400 feet—this height being necessary to secure a flow to the high-level reservoirs within the city limit. The most sanguine estimate would demand, surely, that not less than 800,000,000 gallons daily should be available at the distant power plants. Yet we are informed by the Water Supply Department that a study of the flow of the Hudson in the driest seasons on record shows that it has fallen at Poughkeepsie as low as about 900,000,000 gallons per day. With all due recognition of the ingenuity of Mr. Parrott's proposal, we think that, if the Hudson water were used, considerations of security and permanence would lead to the selection of a steam pumping plant rather than one depending upon the variable flow of the upper Hudson.

THE DELAY OF THE MANHATTAN BRIDGE.

It will be within the memory of our readers that our last article on the Manhattan Bridge controversy was intended to close the discussion, as far as the columns of the SCIENTIFIC AMERICAN are concerned; but we have since received several letters from Mr. Hildenbrand, requesting us to re-open the subject to the extent of assuring the public that our criticism of his published letters was not intended to cast any doubt on his professional ability. We cheerfully comply, if only because of the opportunity it affords us to state, once and for all, the position of the SCIENTIFIC AMERICAN with reference to this matter. The point of view of this journal is that of the individual citizen, who, first and last, is the one that suffers from the inconvenience caused by the delay—the absolutely unnecessary delay as it seems to us—in the construction of this bridge. So long as the Manhattan Bridge be well designed and speedily built, the SCIENTIFIC AMERICAN cares not one iota what engineer writes his name at the bottom of the plans. Our strong advocacy of the design of the former Bridge Commissioner has been absolutely impersonal, and based entirely upon the merits of the case. The Editor formed a favorable impression, from the very first, of the plans for a chain-cable bridge—an impression which was deepened by the indorsement which these plans received from the Board of Engineers appointed by the Mayor to pass upon them.

That Mr. Hildenbrand's name appeared in the columns of the SCIENTIFIC AMERICAN was due entirely to his own act in sending us his letters for publication. We did not approve of his method of argument, and said so. We do not approve of it now. But he is quite in error if he thinks that our criticism was prompted by any motive of disparaging his professional ability. Mr. Hildenbrand may well be content to let his reputation stand upon the fact that he was mainly responsible (if we are not mistaken) for the design of the Brooklyn Bridge. His strong advocacy of the wire cable is consistent, and, we have no doubt, sincere; but in the present controversy we think that he has unwittingly allowed his zeal to get the better of his logic.

It seems to us that what is needed in a discussion of this matter is a broader point of view. Would it not be well for everyone concerned in the agitation that has already deprived New York city of this greatly-needed improvement for a period of nearly three years, to try to look at the question more from the standpoint of the good of the public, and less from the standpoint of personal predilection for any particular type of bridge. We seriously doubt if any of the engineers who opposed the design for a chain bridge believed that it would have failed, if built, to prove perfectly serviceable and safe. Even Mr. Hildenbrand, in his letter published in the SCIENTIFIC AMERICAN of November 4, 1905, says: "They" (the Board of Engineers that approved the rejected design) "were merely engaged for giving their opinion whether the design submitted to them was practical, whether the bridge, after being finished, would be fireproof, durable, and serviceable, and whether it would have sufficient capacity and strength. These questions were answered with 'Yes,' and if I had been a member of the committee, I would, with strict adherence to the

same questions, have given the same verdict." Now, that the bridge would have been heavier than a wire bridge (with all that this involves) no one has ever disputed; yet, in their strong preference for the construction of a wire bridge, the Bridge Department, in spite of the delay which a change necessarily involved, threw aside the plans for a chain bridge, which Mr. Hildenbrand himself believes would have been, though heavier, "serviceable," and of "sufficient capacity and strength," and thereby subjected the city to the present intolerable delay, the extent of which no one can foretell. Herein lies the true burden of responsibility. The result of the agitation against the chain-bridge design has been to cause the city of New York enormous inconvenience, by delaying a most urgently-needed link in its system of transportation.

Mr. Hildenbrand claims that the responsibility for delay dates back to 1902, when the original design for a wire-cable bridge was thrown out. We believe, however, that the original design was both incomplete and inadequate to the increasing traffic, and that, whether a wire-cable or a chain-cable were used, new plans were in any case necessary. We may be wrong; but even if it be granted that the delay in 1902 was unnecessary, that is no justification for the further delay in 1904. Two blacks never yet made a white.

In the present dilemma the Merchants' Association of this city has made to the Mayor a recommendation which we cordially indorse. As matters now stand there are, in the Bridge Department, two complete sets of plans for the Manhattan Bridge. One of these, calling for a chain cable, has been passed upon and approved by a Board of Engineers; the other, which has never been offered for approval by an independent board, has been bid upon, but the bids have been thrown out by the courts. The Merchants' Association suggests that, as the Department is now in possession of two sets of plans, they should both be submitted to an independent board of engineers, and that fresh bids should be asked upon the plans which this board may approve. We sincerely hope that the Mayor will adopt a suggestion which is so sensible, and offers such a simple and quick way out of the present deadlock.

ON A TOUR OF THE SHOPS.

Shop methods have changed greatly in recent years, and school and college trained mechanics are making their influence felt more and more, but the old-time mechanic, with a mind accustomed to dealing with emergencies and able to turn his hand to almost anything, still survives in many of the shops. His training is very different from the younger generation. He knows less about mathematics and accurate drawing to scale, but his intimate knowledge of the practical working of machinery makes him an invaluable factor in every shop. He knows his machinery by heart, and any heart throb that is not natural attracts his attention. He can usually tell by the "feel" what ails a complaining machine. He knows every "cranky" engine or machine in the shop, and he understands how to favor each one to get the greatest amount of work out of it.

But it is in the repairing of machinery that the old-time shop hand is at his best. Here he is in his element. He was brought up in the school which made every machine shop an independent entity. It was impossible in those early days to order duplicates of machinery by telegraph, and expect them to be delivered within twenty-four hours. Consequently, every shop had its resourceful mechanics, who were capable of repairing any machine so that it could continue its work for several weeks until the new parts could be forged or made in some distant factory. It was this very training which made the old-time mechanics such men of inventive genius. If an engine rod broke or a steam box fractured, the mechanic of the shop could repair it so that work would not have to be shut down for long. The breaking of a huge flywheel only meant temporary delay. An old-time shop mechanic recently told me how he had rigged up a wooden flywheel within twenty-four hours after an iron one had broken, and the temporary one worked successfully until the order for a permanent wheel could be filled.

In the modern, up-to-date shop, where nearly every part of the machinery is supplied in duplicate, so that the breaking of any piece merely causes a little shut-down, the tendency has in recent years been to depend less and less upon the old-time all-round, ingenious shop mechanic. The feeling has grown that the human element will be more and more eliminated from the shop as an important skilled factor. It is the machinery which holds sway, and which does the work, and the man who operates it merely holds an inferior position. Yet there are some shops which take the opposite view of this. A visit to one of them a short time ago revealed quite a unique condition of affairs. It was filled with old-time mechanics and shop workers. Very few of the new school were present. Was this an accident or intentional?

"Partly both," replied the superintendent. "I brought most of these men back with me from Mexico, and I shall keep them as long as they care to stay

here. I went down there five years ago to install and run for a year a new railway shop in the city of Mexico. I knew I could not depend upon native labor, and so I selected my men in this country and took them with me. I was warned before I left that there was no possible way of getting duplicate parts of machinery in that part of the country inside of a month or two. It all had to be shipped by train from this country. Therefore it was quite essential that I should take with me men mentally equipped to tackle emergency jobs. I chose the old-time practical shop men, those who had been accustomed to the old methods of independent work. I was not disappointed. Down there we met some pretty ugly propositions in mechanics, for the railroad company was poorly equipped with repairing machinery. But we surmounted every difficulty. Every time we ran up against a hard thing, we held a council of war. Every man had a right to state his way of making the repairs, and then we selected from the list the most serviceable. Well, it would have surprised you to see some of the ingenious and practical methods proposed by those old mechanics. They could have given your new school-trained shop man a mile ahead start and beat him out. They gave me pointers which I haven't exhausted to-day. I shall continue working on them for years to come. When we got through with that Mexican job, I brought the men home, and I consider we have the best set of mechanics in any shop of the country. There is a feeling of responsibility among the men which is difficult to get in a mixed lot.

"We still hold our meetings to consider the best method of proceeding when anything happens, and the men put in their solutions for the trouble just as they did down in Mexico. At these meetings we get an exchange of views that is worth a good deal. For instance, the other day we found it necessary to make repairs to a warped bed on which some heavy machinery stood. The question was raised as to whether we should have a new bed on new foundations, repair the old, or design something of our own. Here is the proposition one of the oldest mechanics and engineers in the shop made: Tear up the old bed and foundation; cut down to hard pan in the soil in a space one foot wider than that required for the machine, and then build up a firm foundation of coarse stones laid in cement, and finish off the top with good concrete. This latter is brought up a few inches below the level for the bed. While the top course of concrete is soft, heavy three-inch oak plank is buried in it, the ends and sides being completely covered with the cement. When the cement hardens, the plank is firmly embedded. On top of this wooden bed fastened into the cement oak planks are screwed firmly, and to the wooden floor thus laid directly on and into the concrete foundations the legs of the machine are screwed. A perfectly level floor bed is thus obtained, and there is absolutely no vibration. When the floor gets warped or worn, the top planks can be taken up and new ones put down.

"This suggestion proved so novel and promising that we have made an experiment with it. We shall lay it under a heavy engine lathe, and if it proves all that is desired, we may repeat it under other machines. Like most shops, we have experienced a good deal of trouble with beds for heavy machinery. They get warped or uneven in a short time where the weight of the machinery is unevenly distributed, and particularly where the pounding of the machinery is over one part. The question of building absolutely firm beds which will neither warp nor drop on one end is a nice one in many shops. The constant raising of ends and putting chips under them to secure a perfect level can hardly be called good workmanship, and yet in many shops this is just what is being done. Beds which will not warp or change the level are greatly to be desired."

It is a fact that in a good many machine, repair, and construction shops, ideas and suggestions are made by the men which are not always received in the right spirit. The tendency to consider a poor mechanic of little account, except in his special line of work, is fatal to the highest efficiency of any single crew of men. Superintendents, foremen, and master mechanics are often so jealous of their own positions, that they resent any suggestions from those below them. Yet it has been the writer's fortune to run up against a number of cases where the most useful inventions in use in the shops came through the suggestions of the men who held inferior positions. They had the knack of seeing how things should be done to save time and labor, and their practical knowledge made their suggestions invaluable.

In a good many shops where devices of a novel nature are in use no drawings whatever exist, or if crude ones were made they have been destroyed. In many cases the men had the designs made according to the suggestions of subordinate mechanics. Frequently such crude devices have saved thousands of dollars to the shops, either through increasing the output or decreasing cost of production. As these devices are not patented they are not put on the market,

and other shops are not benefited thereby. One shop is not inclined to throw open its secrets to another, but where devices are not considered important enough to patent, little harm can be done by an exchange of visits between master mechanics and foremen of shops. New descriptions of shop methods and labor-saving devices would furnish a great amount of data for shop foremen and superintendents to study, and in the aggregate they would greatly raise the general standard of appreciation of the subordinates who work in the various machine, repair, and construction shops of the country.

A. S. ATKINSON.

PROPOSED DAM FOR LAKE ERIE.

BY ALTON D. ADAMS.

Niagara Falls may be given a more constant volume of water by the erection of a dam at the foot of Lake Erie. Such a dam would be of great benefit to the electric power plants about the Falls, and an important aid to commerce moving between the four upper lakes and the St. Lawrence River. These results would follow the erection of a dam at the outlet of Erie because that lake is subject to great fluctuations in level, while Niagara Gorge is only one-fifth to one-tenth as wide as the river above the Falls.

Of the four upper lakes, Erie is much the smallest in area, and its greatest depth is only 84 feet, while that of lakes Michigan and Huron is 1,000 feet, and that of Lake Superior 1,030 feet. Niagara River is the final outlet of the four upper lakes, but the great storage capacity of lakes Superior, Michigan, and Huron is not directly available to maintain its rate of discharge. This is due to the fact that Erie is lower than the three Great Lakes to the west, and connects with them only through the comparatively narrow and shallow channel of the St. Clair River. While the three higher and greater lakes thus supply much the larger part of the water that annually flows down the bed of the Niagara River, its hourly and daily rates of discharge depend mainly on the level of Lake Erie at its lower end. East and west along the length of Lake Erie the winds sweep a course of 290 miles, and pile up its waters at either end. The rise of water level due to wind action is particularly notable at the eastern end of Lake Erie, because it gradually narrows from its full width of 65 miles to the head of Niagara River, where the width is less than one-half mile. A strong wind from the west raises the water level at the foot of the lake, and largely increases the discharge rate of Niagara River, while an east wind has the contrary effect. By the action of wind alone the water level at the head of the Niagara River is varied as much as seven feet either way from the normal. Other causes produce a maximum change in Erie level of as much as four feet. When both the wind and other factors operate together it thus seems that the water level at the foot of Lake Erie may vary as much as nine feet from the normal. At the inlet of Niagara River the greatest depth of water is about twenty feet at normal lake level, and a change of seven feet, or about one-third of this depth, must obviously have a large effect on the rate of discharge. According to the report of the Secretary of War, a rise of Lake Erie level from 579.25 feet above mean low tide, in November, 1899, to 573.12 feet, in June, 1900, increased the discharge rate of Niagara River from 165,340 to 231,350 cubic feet per second. If this rise of 2.87 feet in the level of Lake Erie was followed by an increase of 40 per cent in the rate of Niagara discharge, how great must be the change in discharge rate that follows a variation of seven to nine feet in the lake level? In view of these figures, it is not hard to believe the story that the cliff which carries the American Falls was laid bare some years ago, after a strong east wind had been blowing for some days. The American Falls show the effect of low lake levels much more than do the Horseshoe, because the crest of the former is about seven feet higher than that of the latter. At Port Day, about one mile above the Falls, and where Niagara River is nearly a mile wide, records of the water level have been kept since 1886. In January, 1893, the river level at Port Day was down to 557.4 feet above mean low tide, and in January, 1899, the water level at the same point was up to 565 feet, a rise of 7.6 feet.

Such changes of the river level above the Falls work large variations in the heads of water on wheels in the power plants there, because Niagara Gorge is so much narrower than the river above. For each foot of rise in the river level above the Falls, the rise in the Gorge below is close to five feet. A rise of seven feet in the upper river thus brings about a rise of 35 feet in the Gorge, and the power plants at the Falls are exposed to a net change of as much as 28 feet in the heads on their turbine wheels. This change of head, besides directly affecting the available amount of power, makes the problem of speed regulation much more difficult.

These large changes of water elevation in the Gorge sometimes occur within very short periods. Thus, on November 2, 1897, the water level at the "Maid of the Mist" landing below the Falls was 334 feet above tide, but on November 6 the river surface had risen 27.7

feet, or to elevation 361.7, at the same point. Just above Goat Island, Niagara River is a mile wide. Between Prospect Point and the Canadian bank, below the Falls, the width is no more than 1,000 feet, and after the railway bridges are reached there is a stretch along the Whirlpool Rapids where the width is only 400 feet. The channel in the Gorge for a mile below the Falls is thus no more than one-fifth as wide as the river above Goat Island, and this goes far to account for the fact that changes of water level are five times as great below as they are above the Falls. Navigation by way of the Welland or the Erie Canal is much interfered with by changes of 7 to 9 feet in the water level at the eastern end of the lake, because the regular depth of the former canal is but 14, and of the latter 7 feet. A dam at the head of Niagara River would prevent an excessive discharge of water when the level was exceptionally high at the eastern end of the lake, and would maintain the water surface at a more nearly constant elevation. With no dam at the outlet of Erie, high water there produces an abnormal rate of discharge, much greater than the inflow from the St. Clair River. The consequence is that when the temporary high water at the foot of the lake subsides, its entire level sinks below the normal until the discharge from Lake Huron brings it up. To dam Lake Erie presents no great difficulties from an engineering point of view, apart from the mere magnitude of the work. For a length of one-half mile just below the outlet of Lake Erie, Niagara River is no more than three-eighths of a mile wide between Buffalo and Fort Erie, Ontario, and its greatest depth of water is about 20 feet. A low dam at this point would accomplish the purposes named above.

PRIZE FOR ELECTRIC DEVICE.

A prize contest has been organized by the Hydraulic Power Syndicate of Grenoble, France, relating to a much-needed device for use in electric light or power stations. On the system of wiring which distributes current to the subscribers, each of the branch circuits is established so as to provide for a certain power whose maximum is determined in advance, and the arrangement is made with the subscriber either by contract or meter. It often happens that the maximum of current is exceeded for more or less time, and this causes trouble upon the whole system which the station supplies. It will be of value to have a method which will allow of notifying the subscriber in the first place, and if he pays no attention, of obliging him to return to the conditions of his contract, this without annoying surveillance on the part of the central station. The proposed current-limiting device is to work at a higher power than 5,000 watts and on all kinds of current. It is to give a signal as long as possible before it commences to operate; then it limits automatically the current on the branch line, working every time the proper current is exceeded. It can be set back again, but leaves each time an indication of the resetting. A complete description is to be sent before April 1, 1906, to the *Siège Social du Syndicat des Forces Hydrauliques*, 63 Boulevard Haussmann, Paris, also (if accepted) two apparatus, which are to be tested on the line and in the laboratory. A prize of 2,000 francs (\$500) is to be awarded for the best device.

OFFICIAL METEOROLOGICAL SUMMARY, NEW YORK, N. Y., JANUARY, 1906.

Atmospheric pressure: Mean, 30.13; highest, 30.72; lowest, 29.25. Temperature: Highest, 63; date, 29th; lowest, 13; date 10th; mean of warmest day, 54; date, 23d; coldest day, 20; date, 9th; mean of maximum for the month, 42.8; mean of minimum, 31.8; absolute mean, 37.3; normal, 30.4; average daily excess compared with mean of 36 years, +6.0. Warmest mean temperature for January, 40, in 1880 and 1890; coldest mean, 23, in 1892. Absolute maximum and minimum for this month for 36 years, 67, and -6. Precipitation: 2.98; greatest in 24 hours, 1.63; date, 3d and 4th; average for this month for 36 years, 3.78; deficiency, -0.80; greatest precipitation 6.15, in 1882; least, 1.15, in 1871. Snow: 3.0. Wind: Prevailing direction, west; total movement, 10,451 miles; average hourly velocity, 14.0 miles; maximum velocity, 61 miles per hour. Weather: Clear days, 8; partly cloudy, 9; cloudy, 14. Sleet, 13th, 14th, 20th; fog, 4th, 12th, 16th, 21st, 22d, 31st. Thunder storms, 4th.

Hydrodynamics, elasticity, optics, electricity and magnetism, though originally based on molecular hypotheses and the idea of central forces, in the course of their development found themselves more or less independent of these notions. In all of them the important common feature is the propagation of actions through a medium which can be regarded, at least in first approximation, as continuous. In hydrodynamics and in the theory of elasticity this medium is that unknown something which we call matter; in optics, and later in the theory of electricity and magnetism, it was found necessary to postulate the existence of another medium, the ether.

AN AMERICAN MODIFICATION OF THE PARSONS STEAM TURBINE.

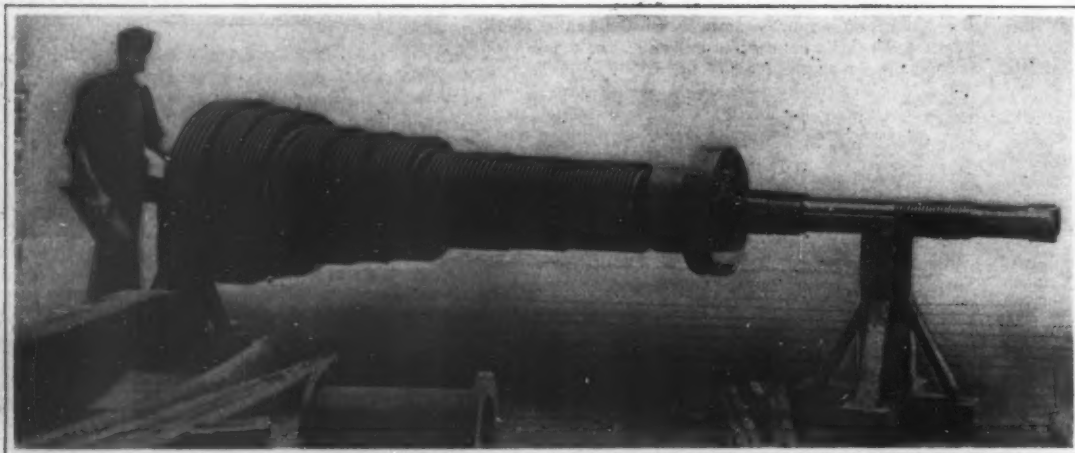
The steam turbine recently installed by the Allis-Chalmers Company at Utica, N. Y., for the Utica Gas and Electric Company, has aroused a great deal of interest. The turbine is rated at 1,500 kilowatts normal load, and is direct-coupled to a two-phase, sixty-cycle, revolving field alternator, which it drives at a speed of 1,800 revolutions per minute. The interest in the new turbine is due not to any new principle of operation, for in this respect it closely follows the Parsons type, but rather to certain constructional features which mark a distinct advance in turbine building. The improvements relate particularly to the manner of assembling the blades and securing them to the cylinder and spindle, also to the novel method of reinforcing and protecting the tips of the blades.

One of our illustrations is a section taken through a portion of the cylinder and spindle showing the blading construction. The blades are formed with dovetailed roots, which are fitted into slots cut in base rings. These rings are also of dovetail shape in cross-section, and are inserted in dovetailed slots cut in the cylinder and spindle respectively, and are secured by key rings in the manner of a Lewis bolt. To hold the key rings in place, the slots are undercut, and after the key rings have been driven into position, they are upset into the undercut grooves. The tips of the blades are reinforced by shroud rings of channel form. The blades are secured to these rings by means of shouldered projections, which are inserted in slots in the rings and riveted over. The slots are uniformly spaced and formed at an angle to position the blades at the proper working pitch. All of these operations are performed by machinery, insuring an absolute uni-

purpose of turning off the shroud rings to give the necessary working clearance, as well as to smooth up the key rings which hold the blading in the dovetail grooves. The workman who was running the tool



A Portion of the Spindle, Showing the Blading.



The Spindle of the Allis-Chalmers Turbine.

formity of blading. The shroud rings, aside from bracing the ends of the blades and preventing any individual blade from working loose, serve also to prevent stripping of the blades in case of contact between rotating and stationary parts. This has been one of the chief difficulties encountered in previous constructions, a difficulty which inventors have long been striving to overcome. The use of shroud rings also permits a much smaller working clearance, reducing loss by leakage of steam past the ends of the blades, a loss which has been very serious in previous constructions.

The blading is assembled in half rings, and carefully tested before being set in position in the turbine. The outwardly-projecting flanges are then turned and bored to provide the necessary working clearance. Owing to their channel form, the shroud rings afford ample stiffness to the construction. Yet the flanges are quite thin, so that if for any reason one of the moving shroud rings on the spindle should come into contact with the stationary cylinder, or if one of the stationary rings on the cylinder should accidentally touch the moving spindle, the friction would not develop a dangerous degree of heat.

The criticism of this method of blading has been made that the blades are weakened at the root, owing to the dovetail formation. In answer to this, it is claimed that while the cross-sectional area at this point is slightly less than the normal section of the blade, yet owing to its shape the blade is really stronger at the root to resist cross breakage than elsewhere. An accident recently occurred at the West Allis shops which served to show the strength of the turbine blading. A turbine spindle with blades assembled was put into a lathe for the

down between two rows of blades accidentally moved the tool rest too far, so that the back of the tool ran into one of the rows of blades. As a result the blades simply bent over as far as the lathe tool could push



Lower Half of the Cylinder, Showing the Blading.

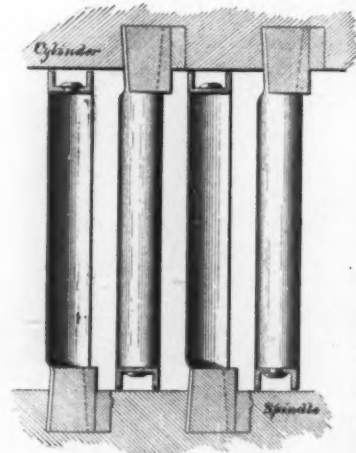
AN AMERICAN MODIFICATION OF THE PARSONS STEAM TURBINE.

them, and the channel shroud ring was distorted by reason of its fastening to the blades, but not a single blade pulled out or broke off at the root, and not a single blade pulled out of the shroud ring or even broke off at that point, where the cross section is less than one-third of the cross section of the root. It was necessary to cut away the shroud ring with a hacksaw before the blades could be removed for the purpose of inserting new ones.

Another feature of this turbine which is likely to arrest attention is the fact that only two balancing pistons are shown. These may be seen at the high-pressure end of the spindle. In previous constructions of this type three pistons are used. As a matter of fact, there are three pistons in the present construction, the third one being applied at the low-pressure end, and being concealed in our photograph behind the large end of the spindle. The advantage of applying the piston at this point is that it relieves the shaft of undue tension, for it will be evident that the greatest axial pressure on the spindle is exerted at the low-pressure end. The piston can also be made smaller than in previous constructions. Instead of using "dummy packing" on these pistons, a packing of radial baffling type has been adopted. That is, the peripheries of the pistons are grooved, and fit into grooved bearings in the cylinder casing. In this manner small axial clearance in the turbine is eliminated.

Rubber from Bark.

The new processes of extracting rubber from the bark of the plant are attracting some attention. In France, Henri Jumelle succeeded in producing rubber and gutta percha from the plant known as *Mascarenhasia longifolia*. Different methods are used, among



Section Showing the Blading Construction.

which he employs the Deiss process. This consists in grinding up the bark and pounding it in a mortar, leaving it for seven days in half a gallon of sulphuric acid for one pound of bark. The black mass which is formed is washed, and the separation of the rubber from the disaggregated bark is carried out in a roller machine having wood rollers between which passes a stream of hot water. A better method is to pound up the acid paste so as to obtain the rubber more quickly, washing the paste then in a continuous stream of cold water. The rubber which is set free is pressed together in the roller machine and left in the air for twenty-four hours. In this way we obtain 6.20 grammes (about 100 grains) of rubber per pound of bark. Another process consists of grinding and pounding up the dry bark, and the powder which falls at first from the sieve does not contain any rubber. What remains on the sieve is again beaten up and agglutinated in hot water. The paste is triturated by hand and at the end of four hours the rubber is separated. Its color is lighter than the above. The Hamet process consists in leaving the crushed bark for two hours in a tight boiler in a 15 per cent soda solution at 130 deg. C. A black paste is formed which is well agglutinated and the rubber separates out in a few minutes by washing in cold water. It is a grayish-brown, but blackens upon drying. It appears that by the above processes we can obtain some 4 or 5 per cent of commercial rubber from the bark of the plant.

It is not practicable to prevent the smoke evil entirely, but only to mitigate it in a degree. Smoke burning, on the other hand, is an impossibility under the conditions which usually present themselves.

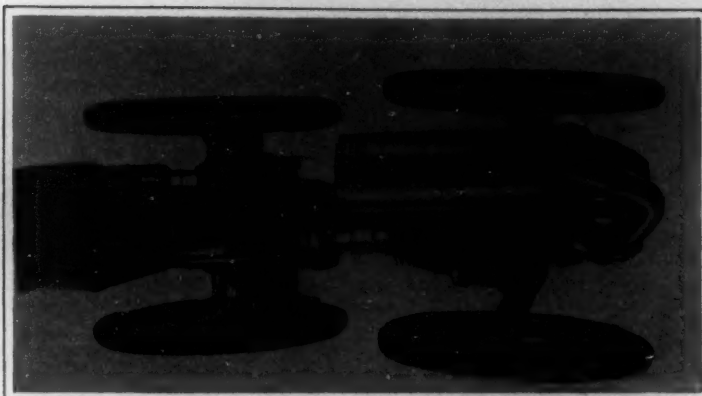
THE MOTOR SKATE—A NEW THOUSAND-LEAGUE FOOT.

BY OUR PARIS CORRESPONDENT.

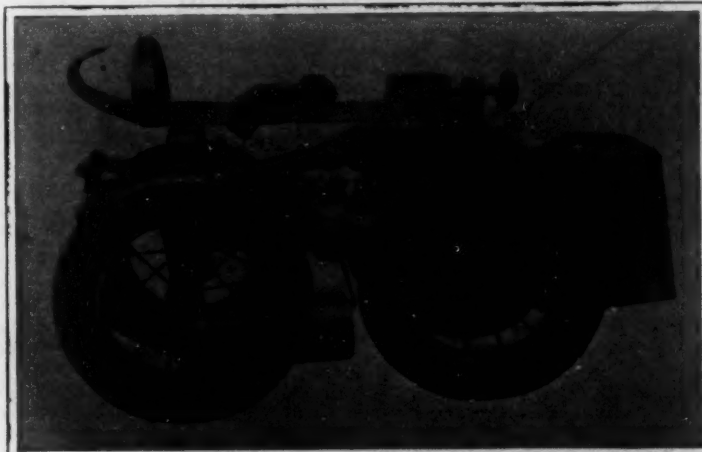
A novel device in the way of an automobile skate driven by a small gasoline motor is the invention of M. Constantini, a well-known constructor of Paris. The new skate consists of a foot-plate which is mounted upon four rubber-tired wheels, while the motor occupies the middle space. Thus the apparatus can be adapted to the foot just as an ordinary roller-skate, the only difference being that the wheels are of a considerably larger diameter. The little device is found to work very well and a person soon learns how to run it. There is no doubt that it will offer a new means of recreation to lovers of sport. It has already attracted considerable attention in Paris, where it has but lately made its appearance. The device consists of two separate parts, first the pair of skates proper, and also the belt worn by the operator and containing a small, flat, gasoline tank. The latter is connected with the carburetor on each skate by a rubber tube which can be readily detached, and near the tank are the valves for controlling the gasoline feed. At first M. Constantini designed the apparatus so as to carry on the belt a small storage battery and spark-coil for the purpose of ignition, and both these are made in a specially small form. But in the most recent type he places both battery and spark-coil in a small metal box with sliding cover, which is fitted upon the back part of the skate against the motor case. The box adds but very little to the size or weight of the skate and lessens the number of connections between it and the belt, so that at present these are reduced to the two tubes for the gasoline.

We give two views of the device, one a side view and the other showing the under side of the skate. The foot-plate is of light and strong steel and is hinged in the middle for steering. Each skate carries a small air-cooled gasoline motor of the usual 4-cycle type such as is used at present on motor bicycles, and it is designed so as to occupy a very small space. Fixed on the motor is a small carburetor; and under the front of the motor, which is mounted in an inclined position, is the cylindrical muffler which a curved pipe connects with the top of the motor cylinder. In the bottom view the muffler has been shifted to one side so as to show the motor. The rear driving wheels of the skate are mounted direct upon the motor crank shaft and thus the motor itself is made to serve as the main support and frame of the skate. The steering wheels in front are mounted on a loose axle which turns about a central pin, and the latter is fixed in a bracket plate which is screwed to the motor cylinder. The wheels carry solid rubber tires which have a somewhat narrow tread combined with a good radial thickness, as this is found to be the best practice. The motor and all the metal parts are nickel-plated, and the skate has as a whole, a neat appearance.

Steering is carried out by working the front part of the plate by the foot. The foot-plate is mounted upon elliptical springs in the front and rear. The foot is held by an adjustable heel-plate which is worked by a screw. A flexible cable connects with the ig-



Under Side of Skate, Showing Battery Box and Motor Crankcase at Left and Flanged Cylinder and Muffler at the Right.



Side View of Skate, Showing the Foot Plate Mounted Above the Motor, Which is Inclined Slightly and the Crankshaft of Which Forms the Rear Axle. The Front Axle Turns for Steering.

MOTOR SKATES, THE LATEST PARISIEN NOVELTY.

Ignition-shifting mechanism and is operated by a handle on the belt. The current can be cut off by a switch.

each developed and withstood a tractive effort of 90 kilograms (198.41 pounds) when driven at a speed

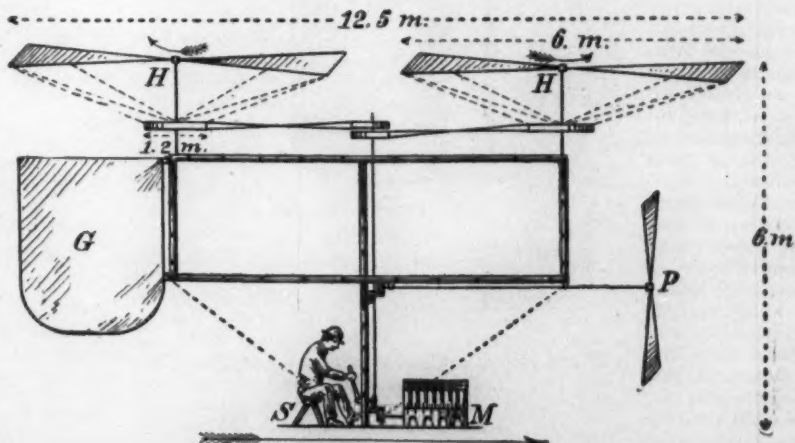


Diagram of Santos-Dumont's Proposed "Helicoptere."

H, H. Lifting propellers. P, Driving propeller. G, Rudder. M, Motor. S, Aeronaut's seat.



SANTOS-DUMONT'S "HELICOPTERE" IN COURSE OF CONSTRUCTION.

The operator puts on the belt and connects the gasoline tube and ignition cable to the skate. He then switches on the current and opens the gasoline feed, pushing the skate with the foot, so as to start the motor. He slows up when desired by shifting the ignition, cutting the current, or lifting the rear wheels from the ground. The skate can be used on a floor or smooth ground, and even upon a good piece of smooth road. A speed of 15 or 20 miles an hour is said to be attainable with it.

THE HELICOPTERE, SANTOS-DUMONT'S LATEST FLYING MACHINE.

BY L. HAMARRE.

Santos-Dumont has constructed a "flying machine" with which he expects to win the Deutsch-Archdeacon \$10,000 prize for machines "heavier than the air."

According to information furnished by the inventor, this new machine is to be a helicoptere, or "screw-flyer," that is to say, an apparatus which will raise, support, and propel itself through the air solely by the power of horizontal and vertical propellers.

For the practical realization of this idea, it is necessary to combine minimum weight with maximum power, and therefore the new apparatus has been designed to develop great power with the lightest possible materials. The frame and the rigging, like those of the dirigible balloons of the same inventor, are made entirely of bamboo, silk, and piano wire; and only the motor and the mechanism for the transmission of power are formed, necessarily, of heavier metal parts.

M. Santos-Dumont has succeeded in performing the almost incredible feat of constructing lifting propellers of a diameter of 6 meters (19.68 feet) and a weight of only 9 kilograms (19.84 pounds). Although these propellers are made entirely of silk and bamboo, they are made of withstood a tractive effort of 90 kilograms (198.41 pounds) when driven at a speed of from 90 to 100 R. P. M. by a 9-horse-power motor. From this result M. Santos-Dumont infers that the same propellers driven by an 18-horse-power motor will sustain a weight of 180 kilograms (396.82 pounds). His entire apparatus, however, will weigh only 160 kilograms (352.74 pounds) and it will be furnished with a 24-horse-power air-cooled motor weighing 35 kilograms (77.16 pounds), or about 3 1/4 pounds to the horsepower.

As may be seen from the accompanying diagram, the helicoptere is formed of a rectangular frame of bamboo, which carries at its ends the vertical shafts of the upper or lifting propellers, H H. In the middle of the frame is a third vertical axis which, prolonged downward, serves as a support for the motor platform. A driving propeller, P, is attached to the bow of the skeleton craft, and a rudder, G, to the stern. The total length of the apparatus is 12.5 meters (41 feet), the total height 6 meters (19.68 feet).

The motor, M, drives (by bevel gears) a vertical shaft carrying at its upper end two small pulleys which transmit the motion, by belts, to two bicycle wheels, 1.20 meters (3.93 feet) in diameter, mounted horizontally on the shafts of the lifting propellers. One of the belts is

Correspondence.

Cement Drain Tiles Wanted.

To the Editor of the SCIENTIFIC AMERICAN:

I see by an advertisement in your paper that it is now possible to make good building blocks of sand and cement at a cost of six cents each—blocks worth eighteen cents each for use in building a house wall. This leads me to suggest that some one of the makers of machines for this purpose might do well for himself and others by inventing a machine for turning out tiles for farm drainage.

Good burnt-clay tiles three inches in diameter cost from ten to twelve dollars per thousand at the factory, but by the time they reach the back-country farmer the cost runs up to twenty-five dollars and often much more. I should suppose that a farmer who has sand at home could make cement tiles at a cost far below that, provided he had the right apparatus.

Of course, such a machine must be, first of all, simple, and to this end I venture to suggest that a tile with the cross section of the letter U might be easier to make than the tube tile. In fact, I have seen the Indians in Central America making roof tiles of that shape by laying the clay half way round a tree trunk of the right size. Better still, I think, might be flat tiles having one edge notched, so that when laid together like the sides of an A roof, they would dovetail together. If well designed, such a line of tiles would never get out of place, and it would drain the land in half the time required by the tube tiles.

JOHN R. SPEARS.

Northwood, N. Y., January 16, 1906.

The Heat of the Subway.

To the Editor of the SCIENTIFIC AMERICAN:

I would judge from the different articles that I have read that the excessive heat of the Subway is somewhat of a mystery, and in your last issue of the SCIENTIFIC AMERICAN you state that a large amount of it is probably due to the powerful action of the Westinghouse brakes. This I will admit is true as far as that goes; however, I will ask this question:

Is it not true that all of the electrical energy fed into the Subway is finally converted into heat in one way or another? I claim that it makes no difference whether the electrical energy is all used in heaters or in motors, the heat units of the current in both cases are exactly the same. If we use this electrical force through electric heaters, the conversion into heat is direct; if we use it to run motors, about 15 per cent goes into heat direct by losses in the motors, and the other 85 per cent goes into mechanical energy or power, which is again converted into heat by the friction of bearings, the brakes, and the wind resistance of the trains. There is no way to fool this natural law, and to make the motors act as generators will give the same amount of heat as the brake shoes for stopping the trains, unless such generators could be used for charging storage batteries, which afterward could be discharged outside of the Subway. Ventilation or cold storage pipes is the only remedy.

E. A. BARNER,

Superintendent Black River Traction Company.
Watertown, N. Y., December 30, 1905.

The Consequences of Water Diversion from the Croton Valley.

To the Editor of the SCIENTIFIC AMERICAN:

The processes of water gathering and sanitary protection of streams in the Croton valley have been going on since 1842, when the first gravity supply was introduced into New York. If these processes have any effect upon the development of a drainage area, whether beneficial or otherwise, this period of sixty years is long enough to afford trustworthy results of what takes place. Such results are not only interesting in pointing out the destiny of this particular valley, but are of importance as an indication of what will take place in other regions under similar conditions.

The Croton watershed of 360 square miles is wholly within the counties of Westchester, Putnam, and Dutchess. The townships which include the watershed are thirteen in number and are 413 square miles in area, so that the area affected by the water gathering constitutes 87 per cent of the area of the townships. The following table shows the population of all the townships in ten-year periods from 1850 to 1900, according to the census returns:

Year.	Population.
1850	24,323
1860	26,068
1870	26,408
1880	27,406
1890	26,405
1900	23,576

The gain in these townships for the ten years ended 1860 was 18 per cent; for the twenty years to 1870, 14 per cent; for the thirty years to 1880, 12 per cent; for the forty years to 1890, 7 per cent; for the fifty years to 1900, the loss was 3 per cent. During this same period of fifty years the State has increased in

population 125 per cent; the county of New York, 300 per cent; the three combined counties in which the Croton basin is located, 113 per cent. The density of population of the townships comprising the Croton basin was 59 to the square mile in 1850, and 57 in 1900. In the combined counties of Westchester, Putnam, and Dutchess the density was 84 in 1850 and 179 in 1900.

The influence for retardation exhibited in the above census figures is remarkable for its persistence, inasmuch as the area affected possessed many features favorable for a normal growth. It contained thirty-one natural lakes and much beauty of scenery to attract residents. As early as 1852 the Harlem Railroad brought the entire length of the watershed into close connection with New York city. Without the presence of the water gatherer it stood in a good position to sympathize in development with the city, which has always had a record of doubling every seventeen years.

That there has been a positive influence against the progress of the townships comprising the Croton watershed is now made manifest and it may be recorded as an indisputable fact that the sanitary control and partial appropriation of land by the city for the purpose of diverting the maximum yield of water has in this instance resulted in retardation.

The question now to be answered by those interested in the welfare of the State is this: Will these same consequences follow the diversion of 500,000,000 gallons daily from the streams in the Catskill region? and, if so, whether or not the devotion in perpetuity of 900 square miles of drainage area is justifiable in the face of the fact that an equivalent supply may be obtained without resorting to the process of diversion at all, namely, by conserving the rainfall at the sources of the Hudson River for the twofold purpose of flood protection and the generation of electric power, the latter to be transmitted by wire to a station near Poughkeepsie and there utilized to pump the river water through an aqueduct to New York. Under this project the expenditure by the city does not injure the inhabitants of any extent of country, but on the contrary equalizes the flow of streams and aids in industrial development.

The estimated cost of the Catskill gravity project is \$161,000,000, and the estimated cost of the Hudson River pumping project is \$108,000,000, showing a difference of 30 per cent in favor of the latter. This wide difference is due to the fact that the required storage in the Catskill region will cost over \$50,000,000, while the required storage on the upper Hudson will not cost \$3,000,000. It would be utterly impossible to spend \$50,000,000 in providing storage for a daily supply of 500,000,000 gallons anywhere in the State except in the Catskill Mountains. The topography of the country explains that fact fully, but the following quotation from the report of Mr. G. W. Rafter, C. E., to the Water Storage Commission points out how favorable in comparison is the topography of some other watersheds for storage. "These several reservoir systems (Hudson, Genesee, Salmon, and Black rivers) have a total capacity of 139,000 million cubic feet, an amount of water sufficient, if uniformly distributed, to produce continuously, under the existing conditions of fall on the various streams, about 400,000 horse-power, worth at \$12 per year per horse-power, \$4,800,000. But \$4,800,000 is the interest on \$120,000,000; hence this amount of money could be actually invested in combined flood protection and water storage for power purposes before the project would become commercially impracticable. As a matter of fact, the storage system here outlined will not exceed in cost \$17,000,000." The average cost for storage for each horse-power in these four river systems is accordingly \$42.50, and at this rate the 55,000 horse-power necessary to pump 500,000,000 gallons of water daily from the river to an elevation of 400 feet can be provided in the upper Hudson watershed by the expenditure of \$2,337,500.

By the generation of electric power at the source of the Hudson and the utilization of this power down stream one hundred miles or more an economy will be brought about that will save the city more than forty million dollars and save the State from sacrificing to the water gatherer what properly belongs to the tax gatherer.

R. D. A. PABOTT,

100 East 17th Street, New York, January 23, 1906.

ORE-UNLOADING BY MACHINERY.

BY DAY ALLEN WILLET.

A new unloading apparatus has recently been placed in operation on the Great Lakes for unloading cargoes of ore and coal. It differs radically from other apparatus for the reason that there is no cantilever and cable bucket system employed for unloading. It might be called a gigantic hull dredge, for in its operation it is quite similar to the modern dredge. The Hulet ore unloader, as it is termed, is undoubtedly one of the most perfect types of vessel unloader which has yet been designed, for it not only removes the material from the hold but literally cleans up the bottom of the ship, so that practically no hand labor is required. This is due to the design of what is termed the un-

loader leg. As the illustration shows, this is one of the most massive parts of the unloader, yet is so adjusted that it can be moved back and forth in the hold. The bucket itself, however, is so ingeniously constructed that, as already stated, it removes practically all of the ore, since it can be adjusted to the shape of the hold. The bucket, as generally constructed, is of ten gross tons capacity, and opened and closed by hydraulic power when steam is used, or by specially designed motors in case electricity is the source of power. The total spread of the bucket when wide open is over 18 feet, and by telescopic motion can be made to reach, when open, more than half-way from the center of one hatch to the center of the other. It also travels lengthways of the hatch to the sides of the boat; consequently the operator is able to reach almost the entire cargo. In an ordinary boat there is no difficulty in reaching 90 per cent of the cargo, and in some of the compartment boats the machines have actually unloaded 97 per cent without the help of shovelers.

The leg to which the shovel is attached is in turn connected to the beam, which answers to the beam of the ordinary steam shovel. It is pivoted, however, and mounted upon a massive truck. In operation, the walking beam, as it is called, is run out upon the truck until the unloader leg with its bucket is over the section of hold to be emptied. The beam is then lowered until the bucket has reached the material and the mechanism controlling the bucket set in motion. When it is filled the movements are of course reversed, the beam raised and moved inward until the bucket is in position to discharge its contents. The truck frame carrying the walking beam consists of two parallel girders mounted upon truck wheels, the girders being installed at right angles to the face of the dock. Between these girders are set hoppers into which the contents of the bucket are deposited. Where the unloaders are used for transferring ore from vessels, the material taken out may be carried some distance to the furnaces or to stock piles adjacent to the wharf. Where the ore is to be carried away by rail, the receiving hoppers are located above the railroad track so that as fast as cars are drawn along beneath, they can be filled by gravity. Where the ore is to be placed on the stock pile the cantilever conveyor is utilized, and is attached to the other end of the unloader, the hoppers being unloaded into the series of buckets which it carries. By means of the cable and trolley, the ore is distributed upon the stock pile as desired.

The unloaders can be operated either by steam or electric power. On the steam-operated machines the power is supplied by a boiler of heavy locomotive type and 175-horse-power capacity, which operates a steam pump capable of supplying the necessary amount of water at 1,000 pounds pressure per square inch. Hydraulic cylinders are used to open, close, and rotate the bucket, to move the trolley and to raise and lower the walking beam. An independent steam engine supplies the power for moving the machine along the docks and for the haulage of the bucket car. On the electrically-operated machines the power is supplied from motors which take their current through sliding contacts, from lines laid along the dock. The motors for operating the bucket are of 80 horse-power, those for hoisting the walking beam are 150 horse-power, for trolleying in and out 50 horse-power, and for operating the bucket car and moving the machine 260 horse-power. The controllers are of magnetic type especially built for heavy service.

In spite of its capacity the mechanism is so compact that only three operators are required to each unloader. The bucket operator, who rides into the hatch and out over the dock with his bucket, controls all motions of the machine, except travel from hatch to hatch and operation of the bucket car, his position in the bucket leg enabling him to watch the work to best advantage. Another operator is required for moving the machine from hatch to hatch and for controlling the bucket car. On the steam-operated machines a fireman is also necessary. On the electrically-operated machines an extra man is usually provided for oiling and adjustments.

The advantage of this mechanism in connection with large smelting plants has caused it to be installed at the works of the Lackawanna Steel Company at Buffalo—an industry which has possibly a greater variety of material conveyors than any other in the world. Here a single unloader will remove cargoes of ore at the rate of nearly 300 tons an hour, taking out 95 per cent of the cargo without the assistance of hand shovelers. Other apparatus installed at the Buffalo works includes a car dumper which is also notable for its design and capacity. It is utilized to carry coal intended for the coke ovens of the Lackawanna Company, and consists of a rotating cradle supported on a rectangular framework. When the car is pushed upon the platform of the dumper it is clamped into the cradle, raised to the proper elevation, and then inverted to such an angle that its contents fall into the dumping bin through a chute. From this receptacle the coal is carried by means of endless conveyors into the receiving bins. By this plan all of the fuel re-

quired for the coke ovens can be transferred from the railroad cars and stored without the employment of any manual labor save to control the operating machinery. This car dumper will handle from 500 to 600 tons an hour, and is also operated by electric power,

ing the ovens. As the illustration shows, the towers supporting them are mounted upon movable trucks and inclose two standard-gage railroad tracks, so that two trains of cars can be loaded at one time. The coke is conveyed from the ovens in pan hoppers suspended

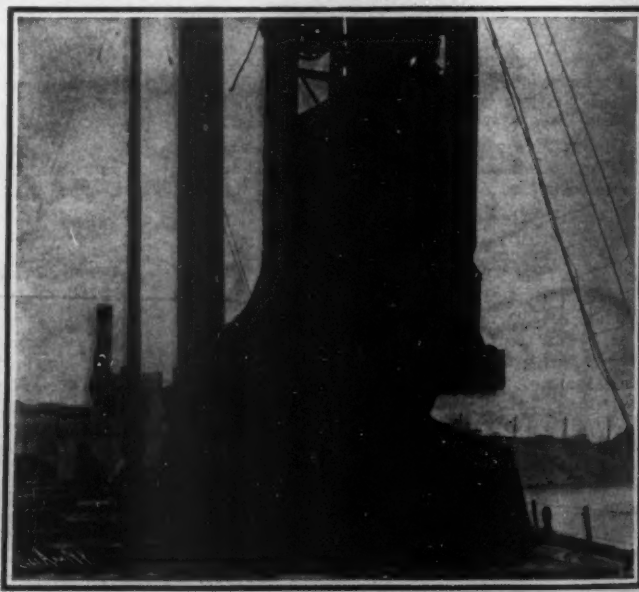
capacity of this apparatus can be gained when it is stated that at present nearly ten per cent of the entire ore tonnage carried from the ranges on Lake Superior to the smelters, is taken out of the vessels by this means. To further facilitate their work a number of



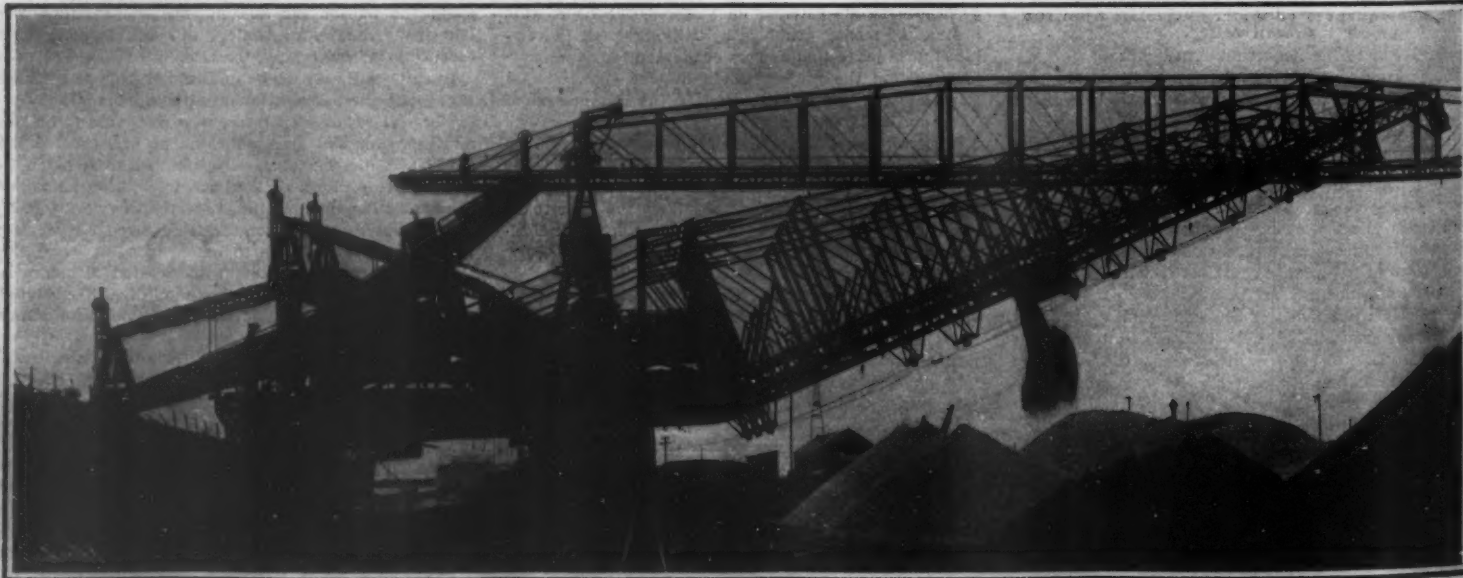
A New Type of Car Dumper. The Car is Being Lowered into the Receptacle at the Left of the Photograph.



Dropping the Leg of an Ore-Unloader into the Hold of a Steamer.



The Operator Stands Within the Leg of an Ore-Unloading Machine.



Ore-Unloader in Service. The Ore is Being Discharged from the Bucket onto the Stock Pile.

ORE-UNLOADING BY MACHINERY.

the motor equipment consisting of two 80-horse-power motors for the tipping mechanism and one 30-horse-power motor for haulage.

In connection with the coke ovens is a series of electric cranes which are devoted exclusively to serv-

from the top of the crane by chains. In loading a car the pan can be tilted at any angle desired, and automatically emptied, as shown in the illustration.

Referring again to the method of unloading vessels by the leg and bucket device, an idea of the enormous

the larger ore carriers have been constructed with holds divided into a series of compartments. Where a vessel is thus designed, it is a fact that cargo can be almost entirely removed—not over 3 per cent being placed in the bucket by hand labor, as already stated

FINAL RACES AT THE ORMOND AUTOMOBILE MEET.

Subsequent to the writing of the report of the races at Ormond Beach, Fla., given in our last issue, a number of interesting races were held on January 27 and 29, the last two days of the meet.

The event of the former day was the 100-mile race, which was run over a 15-mile course requiring six turns. Two English Napier machines—a 100-horse-power, 6-cylinder racer, and an 80-horse-power, 4-cylinder car—were the star performers in this event, as the former won the race after running 65 miles on the rim of one of its rear wheels, while the latter

Earp on his 100-horse-power Napier at the end of 50 miles. At this point he lost a tire, and consumed 7 minutes in replacing it. Earp passed him, and gained sufficiently to stay in the lead during the second half of the race. His lead of $2\frac{1}{2}$ minutes thus obtained was reduced to only $58\frac{3}{5}$ seconds, however, at the finish, although he was still 2 minutes and 26 seconds ahead at the 70-mile point. The right-hand rear tire of his machine came off after he had gone about 35 miles, and he ran the balance of the race on the rim without stopping. Our photograph, which was taken late in the afternoon just after the finish, shows the

horse-power De Dietrich, and was an increase in speed of but $3\frac{1}{4}$ miles per hour. The Napier machine has the same engine that was used in the races last year. In fact, with some minor changes, it is the same machine which, in the 1905 meet, covered 10 miles in 6:15 at 96 miles per hour—a record which still remains unbroken. Its 80-horse-power mate was third in 1:20:05, while Cedrino's Fiat obtained second place in 1:16:39.

Among the races run on January 29 were a 10-mile open handicap and a 15-mile championship race, both of which were won by Lancia in 6:18 $\frac{2}{5}$ and 10 min-



The 100-Horse-Power, 6-Cylinder Napier Racer Driven by Earp, as It Appeared at the Finish of the 100-Mile Race. The Last 65 Miles Were Run Without a Tire, as Shown.

This machine covered 100 miles in 1 hour, 15 minutes, 40 seconds, at a rate of speed of 79.28 miles an hour. It reduced the 100-mile record by 2 minutes and 44 seconds. An 80-h.p., 4-cylinder Napier was third in 1:20:05.



The 200-Horse-Power, 8-Cylinder Darracq Racer with Demogent at the Wheel. This Car Was Specially Built for the "Two-Miles-a-Minute" Race, Which It Won.

After reducing the kilometer record 1 second in France last December, this car succeeded in covering two miles in 58 seconds on the beach at Ormond. This is equivalent to a mile in 29 seconds—a speed of 129.46 miles an hour—and is the fastest time ever made by a gasoline automobile.



The 50-Horse-Power, Light-Weight, Stanley Steam Racer—the Speediest Self-Propelled Vehicle Ever Built—Which Came Within $2\frac{3}{4}$ Miles an Hour of Equaling the Highest Speed Attained by an Electric Car Running on Rails—130.4 Miles an Hour.

In the mile speed trials this machine covered that distance in 20 seconds—a rate of speed of 127.65 miles an hour—while in the "Two-Miles-a-Minute" race it consumed 59 seconds, which is equivalent to a speed of 130.8 miles an hour. It also won the 50-mile race for American machines in 34 minutes, 19 seconds.

RECORD-HOLDING RACERS AT THE ORMOND AUTOMOBILE MEET.

finished third only 4 minutes $24\frac{3}{5}$ seconds behind its mate. Besides these two cars the starters included two 110-horse-power Fiat machines driven by Lancia and Cedrino, Chevrolet on the 100-horse-power Christie, and Harding on a 45-horse-power English Daimler. The 80-horse-power Darracq Vanderbilt cup winner was ruled out because it had no differential gear. The Christie and Daimler machines quit the race before covering half the distance. Lancia lost a tire soon after covering 40 miles, and shortly after a leak developed in the radiator, which put him out of the race. Cedrino was $4\frac{1}{2}$ minutes ahead of

wheel minus its tire and the intrepid driver with his mechanic. Under the extremely unfavorable condition of running on the rim about half the distance, Earp covered 78 miles and made five turns in 52 minutes and 57 seconds, or at the rate of 88.48 miles an hour. Cedrino also broke a record by covering 40 miles in 25 minutes and 6 seconds, or at a rate of speed of 95.61 miles an hour.

The race was won by Earp in 1 hour, 15 minutes, $40\frac{2}{5}$ seconds, or at a rate of speed of 79.28 miles an hour. This was only 3 minutes and 44 seconds better time than was made last year by Fletcher on an 80-

utes respectively, with Hilliard on the 80-horse-power Napier second in 8:03 $\frac{4}{5}$ and 11:36 $\frac{2}{5}$. The 30-mile race for American cars had but three competitors—the Stanley steam racer and the 100-horse-power Christie and Ford machines. The last-named car ran into the soft sand at the 15-mile turn and was stuck fast. The Christie car had trouble from overheating, and was obliged to renew its water supply at the club house within 4 miles of the finish. The Stanley steamer started 5 minutes and 40 seconds after the other cars. When passing the club house, Mariott slowed it down, thinking he was at the finish. He found out his error

and made a spurt, finishing in 34 minutes 15 2/5 seconds, with Christie some 3 minutes behind him in 37:24 3/5.

The final and most interesting event was the "two-miles-a-minute" race. The only competitors were the 8-cylinder, 200-horse-power Darracq, and the Stanley steamer. As recorded in this journal last week, the steamer had previously covered a mile in 28 1/5 seconds, at the rate of 127.65 miles per hour. In the "two-miles-a-minute" race both machines were obliged to make two trials. These attempts were made separately. The first one, which was made by the steamer, resulted in the comparatively slow time of 1:03. The Darracq did much better than this, although one or two of its cylinders were missing fire, and on its first trial it consumed only 3/5 of a second over a minute. The second attempt of the steamer resulted in 59 3/5, or 29 4/5 seconds to the mile, which was a rate of speed of only 120.8 miles per hour—7.85 miles per hour less than the steamer had previously done in the mile trials. A third attempt at the record was not allowed. The Darracq machine made a slightly faster showing. It covered the two miles in 58 4/5 seconds. This is equivalent to 29 2/5 seconds to the mile, or 122.46 miles per hour. This machine, like the Stanley, was especially constructed for the "two-miles-a-minute" race. Its engine is twice the size of that in the 80-horse-power racer which won the Vanderbilt Cup race last October. The eight cylinders are set at an angle of 90 deg., forming a V. They are 170 millimeters (6.692 inches) bore by 140 millimeters (5.511 inches) stroke, and they have a total piston displacement of 1,551.68 cubic inches. The present racer has the radiator arranged to form a sharp prow, and the cylindrical water tank is also pointed. While this may make some difference in the air resistance, the fact remains that, roughly speaking, it has required a doubling of the horse-power to make an increase of one-third in the speed. If the same ratio holds, to obtain a speed of 150 miles per hour with a gasoline machine, at least 350-horse-power would be required. How these figures compare with those of the steam racer may be seen from the following facts regarding the latter which have been sent us by the inventor, Mr. F. E. Stanley.

The wheel base of the racer is 100 inches and the tread 54 inches. The rear or driving wheels are fitted with 34 x 3 1/2, and the front wheels with 34 x 3-inch standard G. & J. clincher tires. The wheels are of the wire spoke type, the tires being bolted to the rims with eight tire bolts and being so perfectly balanced with counterweights that there was no vibration when the wheels were making upward of 1,300 revolutions per minute. The running gear is the same as that used on the Stanley touring car with the exception of the wheels, which have wire instead of wooden spokes. The body of the car is built entirely of wood, and mounted on four full-elliptic springs. The springs are placed on the inside of the body, so as to reduce the air resistance to a minimum. Ball bearings of the two-point type, with 3/4-inch balls, are used in the running gear.

The body is 16 feet long and 3 feet wide at the widest part. It is pointed in front, and terminates at the rear in a circle with 8-inch radius, tapering to 3-foot width and to the point in front with cycloidal curves, or curves with constantly diminishing radius. The bottom of the car is perfectly straight and smooth. It has a clearance of 10 1/2 inches. The sides are vertical to a height of 18 inches, and from that line the removable top is oval, curving both transversely and longitudinally. The largest cross section, including the wheels, amounts to 9 square feet.

The power plant consists of a boiler 30 inches diam-

eter and containing 1,476 tubes of 33-64 inch outside diameter and 18 inches long. The boiler contains 285 square feet of heating surface. The steam was superheated, by passing it through tubes surrounded by the contents of the boiler and through coils of pipe in the fire box, to a temperature of about 700 deg. F.

The engine is of the two-cylinder double-acting type, with cylinders 4 1/2-inch bore by 6 1/2-inch stroke. It is fitted with Stephenson link valve gear and D slide valves. The engine makes 350 revolutions to the mile, while the 34-inch driving wheels make 600 revolutions to the mile. Linked up as the engine was in forward gear, the cut-off was about one-third stroke, and the mean effective pressure about one-half the steam-



Lighthouse During Removal.



The Lighthouse Before Removal, Showing the New Foundation.



Lighthouse After Removal.

REMARKABLE ENGINEERING FEAT—MOVING A GERMAN LIGHTHOUSE.

chest pressure. The engine therefore develops 6 horse-power for each 100 revolutions per minute, and each 100 pounds steam chest pressure. The boiler will furnish steam for 50 horse-power continuously, and more than twice that amount for three minutes or more. About 275 pounds to the square inch steam pressure is carried.

The arrangement of parts of the power plant is as follows: The boiler is placed just back of the center of the body, the water tank between that and the rear axle. The engine is geared to the driving axle by spur gears, and is placed horizontally at the rear of the axle, so that the driving force of the engine tends to lift the front axle and transfer the load to the rear axle, thus giving the greatest possible traction to the driving wheels.

In making the record of 28 1/5 seconds for the mile, the power developed was probably about 120 horse-power. The engine made 750 1/2 R. P. M. and the 34-inch driving wheels 1,286 1/2 R. P. M.

The total weight of the machine was 1,675 pounds. The boiler weighed 525 pounds; engine, 185; burner and fire-box, 75; pumps, tanks, etc., 50 pounds; making the total power plant 835 pounds, or less than half the total weight of the machine.

MOVING A GERMAN LIGHTHOUSE.

BY DR. ALFRED GRADENWITZ.

Though the removal of buildings has long been a commonplace matter in American engineering practice, the readers of this journal will doubtless be interested in the following description of a removal work fraught with greater difficulties than the removal of even considerable masses, owing to the comparatively great height and small ground surface of the building, which was a lighthouse tower. In fact, even the slightest inaccuracies in preparing the slideway might result in considerable oscillations of the tower, while oscillations due to storms had to be prevented by lateral props. It should also be borne in mind that these lateral props had to uniformly follow the motion of the tower. This was effected by installing, in parallel to the sliding props, some girder constructions carrying crabs, and attaching to the latter the steel wire ropes propping the tower.

The Hamburg Department for Commerce and Navigation recently ordered the Wittenbergen lighthouse tower to be displaced with a view in future to avoid the continual dredging work necessitated by the alluvial sand. The width of the channel having to be increased from 142 to 200 meters, the Wittenbergen lighthouse was removed southward by about 9 meters. In order not to interrupt the operation of the lighthouse, arrangements had to be made that the tower might immediately find a solid foundation in its new position. The new foundation with all the necessary mooring, etc., was therefore made at a convenient location some 30 feet distance from the old place. The sliding way from the old to the new foundation was made of heavy ingot iron girders on which double coupled steel rollers moving the tower were allowed to run. The motion was effected with a strong hand-driven winch by means of a wire rope, while another winch was installed at the rear (with regard to the direction of motion) with a view to avoid any displacement of the tower in the case of storms.

In addition there was a winch installed in front and another behind, the wire ropes from which were fixed on the top of the tower to avoid any oscillations. A special point was made of synchronism in the working of each of the winches. In order to protect the tower against oscillations due to lateral thrusts, two wire ropes connected to crabs were arranged on each side, these crabs running on girders mounted in parallel to the sliding way.

The whole of the removal

work occupied 32 minutes. The lighthouse tower weighs about 60 tons, and is 115 feet high. The cost of the removal work proper, which was carried out by the contractors themselves, amounted to about 7,000 marks, exclusive of the masonry and carpentry work, executed by the Hamburg Hydraulic Engineering Department.

Liquid for Sanitary Spraying.

A liquid for sanitary spraying, for use in the chambers of the sick, is composed of 10 parts of eucalyptol, 3 parts of thyme oil, as much lemon oil, and the same quantity of lavender oil, in 110 parts of alcohol of 90 deg. To a pint of water add a teaspoon of this liquid. —Jour. Parf. et Sav.

REMARKABLE PHOSPHORESCENT ANIMALS.

BY CHARLES FREDERICK BOLDER.

For some reason the Pacific coast of the United States, particularly California, has always been famous for its displays of phosphorescence—that strange phenomenon over which many men have spent years of study, and which, to a large extent, is still mysterious and unexplainable, though it should be said there are not theories and pseudo-explanations lacking.

The islands of Southern California from the Coronados to the Santa Catalina group of four, opposite Los Angeles County, to the Santa Barbara group of four in the channel of that name, are the points most available for observation, due to the peculiarities of the coast. The Coronados, Santa Catalina, San Clemente, Anacapa, Santa Cruz, Santa Rosa, and San Miguel all lie more or less parallel to the coast, affording that necessary feature for extended investigations—a perfect lee; the water often being so smooth that it is difficult to believe one's self at sea.

As these islands all rise out of the blue depths of the ocean, and are washed by offshore currents, they afford a remarkable field for the zoologist, and it can be said that there is hardly an animal obtainable from the Naples aquarium that cannot be found, or its prototype, along these shores from Point Conception above Santa Barbara to San Diego. The observer is particularly impressed with the richness of the invertebrates found here, ranging from giant jelly fishes twenty feet in length, which in all sizes often appear to fill the sea, to the graceful Porpita, Velella, and Physalia, and during the late winter months the delicate paper nautilus is sometimes found, and has been kept alive and watched.

Students of animal phosphorescence have read of the *Pyrosoma*, one of the Ascidians whose wonders of light have made it famous. One of these beautiful animals was caught off Avalon Bay some time ago, and in all probability the first photograph of the animal ever taken is shown in the accompanying illustration. It was first seen as a blaze of light as large as a bucket, ten or more feet below the surface, and supposed to be a large jelly fish; but as it was watched through the window of a glass-bottom boat, it was seen to rise and to be long and cylindrical. The finder called it a "fire barrel," not an exaggeration, as when the strange object reached the surface it was seen to be barrel shaped, about a foot in length, open at one end and emitting a faint light; but the moment it was touched as the finder placed his hands beneath it, it blazed out in a vivid glare of green silvery light. The discoverers were not naturalists, but they saw that the animal was alive, and that a stream of water was pouring from the open end, forcing the strange object along. It was caught in a pail and successfully placed in a tank, and doubtless the first large *Pyrosoma* seen alive in America was closely observed. It would be difficult to exaggerate the beauties of this animal. In a specimen the writer kept in a dark room in the Gulf of Mexico, by stirring it with a stick, light was produced sufficient to read medium-size print, and the sight was a ghostly one, the large type standing out with marvelous distinctness.

At certain times the *Pyrosoma* is fairly common in the San Clemente channel, but specimens larger than a foot or so have never been seen. It is in the tropics that the animal is at its best. Moseley describes one as follows: "The most beautiful kind of phosphorescence is, however, that of the Ascidian colony of *Pyrosoma*. This, when stimulated by a touch, a shake, or a swirl of the water, gives out a bright globe of bluish light which lasts for several seconds . . . and then goes out suddenly. A giant *Pyrosoma* was caught by us in the deep-sea trawl. It was like a great sac, with its walls of jelly about an inch in thickness. It was four feet long and ten inches in diameter. When a *Pyrosoma* is stimulated by having its surface touched, the phosphorescent light breaks out just at the spot stimulated and then spreads over the surface of the colony to the surrounding animals. I wrote my name with my finger on the surface of the giant *Pyrosoma* as it lay on deck, and my name came out in a few seconds in letters of fire."

The *Pyrosoma*, as soft, jellylike, and insignificant as it appears, stands high among the great branches of animal life, being a tunicate in the order Chordata, leading up to the fishes, the larvae of some forms showing a notocord believed to be a primitive vertebra or backbone.

Humboldt has described the radiant beauties of these fire bodies as he saw them like stars in the bed of the ocean; and so brilliant was their light, that he could distinguish fishes by their radiance. The *Pyrosoma* or fire body has on many occasions astonished observ-

ers by its splendid light that varies in tint and color. Thus those observed by Bennett, the English naturalist, gave out a splendid pale greenish light, while M. Peron, the French zoologist, met a school of them near the Isles of France, and describes them as resembling



Luminous Living Heteropod from Avalon Bay, California.

"red-hot balls of iron." In all probability, Bibra, the Brazilian naturalist, was the first to utilize their light when he placed six small specimens in a swinging glass in his cabin, and used their brilliant light as a lamp, by which he wrote a description of the animals and their beauties. Sir Wyville Thompson, referring



Salpa (*Cylindropsylla affinis*).

Squilla.

Photographs of Two Living Luminous Animals.

to the blaze of phosphorescence and train of intense brightness that followed the ship, while he did not use them in his cabin as lamps, says: "It was an easy matter to read the smallest print sitting at the after port in my cabin; and the bows shed on either side rapidly widening spaces of radiance so vivid as to



The "Firebarrel" or *Pyrosoma*. Photograph from Life.

REMARKABLE PHOSPHORESCENT ANIMALS.

throw the sails and rigging into lights and shadows." The animal resembles faceted jelly, and is really a colony made up of innumerable pseudo-individuals bound together by insoluble ties. Each individual in feeding draws water from the outside and ejects it on the inner side; and as countless jets are being forced out, a stream is formed which forces the entire colony along in the direction it happens to be headed. The light of the Atlantic forms is an intense green, but in very large individuals it is blue. When handled, a peculiar albuminous substance is exuded that is also phosphorescent. The impression is conveyed that the entire animal is luminous, but this is not so. In the illustration little tubercle-like objects are seen covering the animal. Each indicates a zooid, and each of the latter has two luminous spots, according to Panceri, "situated over the position of the ganglia of the nervous system." At times the *Pyrosoma* does not show a light, but if it is disturbed or injured, the light will start at the point of impact, and spread with wonderful rapidity from point to point until the entire mass is ablaze with light.

It is well known that some of the most remarkable light-givers are crabs, and of all the crustaceans the one shown in the accompanying photograph is perhaps among the most interesting. The writer kept several from the Atlantic and the Gulf of Mexico, and had never noticed their phosphorescence. A large and beautiful specimen was dredged off Avalon Bay, California, and placed in a tank, that its beauties of color—red, blue, purple, and green—might be observed. It happened that in looking at the tank one night the squilla was seen to be surrounded by a peculiar light, which examination showed came from the ventral fillets, or some part of them, sufficient to make the strange crustacean stand out in lines of gold. The animal, at least in the Pacific waters, is a deep-water form, and one of the most attractive of all marine animals in its marvelous coloring. It is very active, having a wonderful swimming apparatus, darting about with great velocity.

In the waters, twenty miles off San Pedro, may be seen the Salpa, a wonderful light-giver. Chains of them ten or even twenty feet long have been placed in tanks, and their light witnessed at night. Of all the luminous animals, these are among the most wonderful. In the illustration the claspers are seen on the upper end. The light is confined to the so-called nucleus of the animal, and bodies of water twenty miles square have been seen glowing with light and color from them. In some, the light is silvery, in others red or blue, while some refuse to respond. The writer has seen the Santa Catalina channel, which is from eighteen to twenty miles wide and practically forty-five miles long, off Los Angeles County, so filled with these radiant creatures that as far as the eye could see they were the fraction of an inch above the surface and gleaming like gems in the sunlight. They constitute the food of the whalebone whales, and many of the large animals were seen at this time reveling every day in the delicacy.

Interesting light-givers are the low Heteropods—the dazzling white, seemingly shapeless forms shown in the accompanying photographs. They float slowly in the water, and are common in Avalon Bay in summer, and often seen floating in the clear blue water. It is difficult to locate the seat of the light in them. Those observed by the writer, when irritated, gave out a light seemingly over the entire surface, but Giglioli refers to one in which the light was red and confined to the axis of the body. They are lowly but interesting creatures, with transparent bodies, a sucker-like organ by which they can cling to the weed, and a long powerful tail or swimming organ. Some of these forms have minute shells; others are shell-less. The *Phyllirhoe*, a free-swimming, sluglike mollusk, common here, is a brilliant light-giver; a dangerous possession, it would seem, as it is a signal that cannot fail to attract the attention of marauding fishes. The sight of these waters at night is at times awe-inspiring. One glances down into the depths, and sees myriads of forms passing and repassing, all blazing with this mysterious light.

The production of aluminium in the United States has increased nearly ten-fold in as many years, according to the annual report of the United States Geological Survey for 1904, which has just been completed. The output of 1904 was 8,600,000 pounds, as compared with 7,500,000 pounds in 1903, and 7,300,000 pounds in 1902. When it is remembered that the industry dates its beginning from 1883, in which year the production was 83 pounds, its rapid development will be appreciated.

Action of Mineral Substances on Milk.

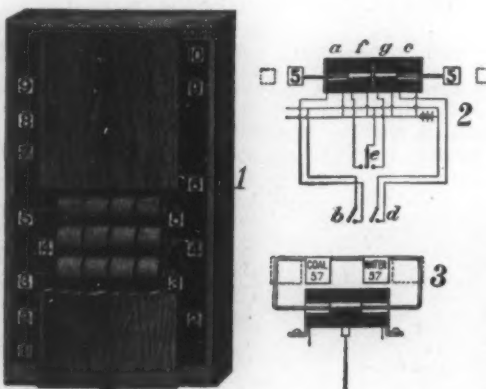
Experiments have been made as follows: (1) On lime in the form of milk of lime; (2) on chlorine, in the form of sea-salt; (3) on phosphoric acid (phosphate of lime); (4) on iron (neutral acetate of iron). The animals received as nourishment green herbage, *ad libitum*, and a daily ration of half a kilogramme of linseed oilcake and half a kilogramme of malt grains.

The results of the tests may be summed up as follows: (1) The mineral substances, lime, chlorine, iron, and phosphoric acid, in combination with the nourishment of the cows, do not sensibly modify the quantity of the milk produced, or its proportion of fatty matters. (2) The total percentage of ash in the milk of the cow is very constant; it is scarcely influenced by the absorption in noticeable quantities of mineral substances. (3) Among the mineral substances experimented on in analysis, lime is that which is found in the most variable proportions in the ash, proportions which may be somewhat influenced by the alimentation. (4) The percentage of lime in the ash may be raised by several centesimal units (3 to 6 per cent) from the fact of the absorption by the animals of important quantities of lime. (5) This absorption may augment, not only the percentage of lime in the ash, but also that of a given quantity of milk. (6) The increase of the percentage of lime in the ash or the milk takes place, not only with the absorption of caustic lime, but also with that of lime phosphate. (7) Nevertheless, the increase in the percentage of lime in the milk consequent upon the alimentation is so slight that it is of no importance in regard to the properties of the milk; besides, it is restricted to narrow limits of the percentage of lime in the produce of different cows. (8) The absorption of sea-salt by the animals does not increase the percentage of chlorine. Even for portions higher than the animals can support, the increase in the percentage is scarcely perceptible. (9) The percentage of chlorine in the milk increases very considerably with the progress of the period of lactation, independently of saline alimentation. (10) The percentage of phosphoric acid, as well of the milk as of its ash, is not at all affected by considerable quantities of this substance, at least in the form of lime phosphate. The question whether the increase of the proportion of phosphoric acid in the milk only falls when this already contains a high proportion of it, has not yet been settled; it is

not impossible that in the case of a milk otherwise poor in phosphoric acid, this proportion may increase as a consequence of a phosphate alimentation. (11) The percentage of iron in the milk is not sensibly affected by alimentation.—Condensed from the French of M. Schulte. Communication to the Fédération Internationale de Laiterie.

AN IMPROVED ANNUNCIATOR.

A recent invention provides an annunciator in which there are no mechanical devices of any kind for moving the signals into view. Instead, a series of solenoids is used and the signals are attached to the floating cores of these solenoids. Each solenoid comprises two coils, one of which is energized to move the signal into view, while the other is used to withdraw the signal. The core is either square or oval in cross section and fits into a bore of similar outline. This holds the signal in an upright position, preventing it from falling over. In Fig. 1 we show the annunciator as applied to an elevator car and a diagram of the electrical connections is shown in Fig. 2. It will be observed that the solenoids are arranged in pairs, those on one side for operating the "up" signals, and those on the opposite side for operating the "down" signals. The outer coils, *a*, of the "up" solenoids are respectively connected to the switches or



AN IMPROVED ANNUNCIATOR.

buttons, *b*, on the different floors, and the coils, *c*, of the "down" solenoids are connected to the buttons, *d*. The operator can thus signal his desire to ride up or down from any floor, in the usual manner. The inner coils of the solenoids are all operated by a common switch, *e*. The switch may be thrown to one side to energize the coils, *f*, and thus withdraw all the "up" signals, or to the other side to energize the coils, *g*, and thus withdraw the "down" signals. The absence of any levers or other mechanical devices for moving the signals renders the apparatus very compact. The annunciator illustrated measures but 5 inches by 8 1/2 inches and is only 1 1/4 inches thick. It can be used either on a main or a battery current and can be wired to withdraw any single signal on either the "up" or the "down" side or to withdraw all the "up" and "down" signals at a single touch of the push button. In Fig. 3, a modification is shown which may be used in hotels. The solenoids comprise two coils as in the construction just described, but each solenoid is arranged to exhibit either of two signals. When one coil is energized one of the signals is brought into view and when the other is energized the other signal is exhibited. The signals are withdrawn by energizing both coils at once, when the core is moved to the neutral position, as shown in the drawing. Messrs. James and William Patten, 2535 Eighth Avenue, New York city, N. Y., have recently procured a patent on this improved annunciator.

Aeronautical Note.

In addition to the \$10,000 prize already offered by M. Deutsch for first covering a certain specified course in the air above Paris with a flying machine of the "heavier than air" type, this gentleman has recently given a \$2,000 challenge cup which is to be competed for by all kinds of aeronautical apparatus and which will be held permanently by the club which wins it three years in succession. The airship or flying machine that goes 100 kilometers (62 miles) to a specified point and returns to the starting place in the quickest time will be declared the winner. A cash prize of \$4,000 will be given in 1906, 1907, and 1908 to the man who pilots the winning machine. Capt. Ferber, of the French army, is having built by the Buchet Company a light-weight motor for a motor-driven aeroplane with which he expects to compete for the Deutsch prizes.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC SWITCH FOR STREET ARC LAMPS, ETC.—P. H. F. SPIES, New York, N. Y. The object of the inventor is to provide a switch more especially designed for street arc-lamps, chandeliers, and the like and arranged to keep the main-line circuit completely uninterrupted whenever the lamp is cut or lowered for the insertion of new carbons or for repairs or other purposes, the lamp on being returned to its normal position being immediately and automatically cut in without interruption of the main-line circuit.

Of Interest to Farmers.

SICKLE.—P. E. FLETCHER, Ridge, Ore. This sickle mechanism is designed to be used in connection with a harvester, reaper, or binder, the object being to provide a mechanism that will be of comparatively light draft, thus requiring but little power to run it, and further, to employ a very thin sickle-blade that may be readily sharpened with an emery-wheel without removing the blade from the machine.

COMBINED SEEDING AND MANURE-SPREADING MACHINE.—D. TOSCANI, Rocca Imperiale, Italy. The object of the invention is a machine which opens furrows in the ground to receive the grains or seeds, spreads in said furrows the seeds at equidistant intervals, together with the manure necessary for their successive development, and then covers the seeds and the manure spread in the bottoms of the furrows.

MOTOR PLOW.—H. J. KYLE, Tipton, Ind. The improvement pertains to plows such as used upon farms for tilling the soil. The object of the invention is to produce a plow which will be advanced by a motor carried on the framework thereof. Special objects are to provide operating mechanism which is of simple construction and which enables the operation of the plow to be easily controlled by a person not skilled in mechanical arts.

BINDER ATTACHMENT.—A. WILLIAMS, Joliet, Mont. In the present patent the invention is an improvement in self-binding harvesters, and it has for an object the provision of a novel construction by which to collect and save the grain and grass-seed which are ordinarily wasted off the deck of the binder.

PLOW.—S. S. WEAVER, Carrollton, Mo. The invention relates particularly to a plow intended for preparing the soil for seed, in which plow means are provided for acting on the subsoil at the bottom of the furrow. The object is to provide a device which may be readily attached to existing plows of this class and by means of which the subsoil may

be effectively cultivated and furrows prepared for the reception of the seed.

BALE BINDER AND TIE.—W. C. MORGAN and T. GILLOON, Dubuque, Iowa. It is intended that the device is to be mounted upon the frame of any power baler or one that has a self-feeding arrangement, and it is so arranged that the power may be taken from any shaft of the baler, according to the style and construction thereof. The invention saves time, increases the capacity of the baler, saves the service of tying, saves in the length of wire and therefore its cost.

DEVICE FOR LOADING SUGAR-CANE.—G. D. LUCE, New Orleans, La. A loading attachment to carts and other vehicles for loading sugar-cane or like material is provided by this inventor. The device includes a permanently-attached standard adapted to receive removable cranes, which cranes are provided with grapples and with means for raising and lowering the grapples and operating their trips, together with means for swinging the cranes on their supports, the cranes being independent in their action.

Of General Interest.

STEAM-TRAP.—W. BLETSO, Youngstown, Ohio. This improvement relates to a trap of that class in which the steam and water of condensation are entered into a chamber the outlet of which is sealed by a valve and in which when the water attains a certain height in the chamber the valve is opened and the steam-pressure is permitted to discharge the liquid contents of the chamber. Primarily the object is to improve the general design of the trap and provide means for effectually and rapidly operating the discharge-trap.

EXTENSIBLE HANDLE.—D. LAWSON, New York, N. Y. In the present patent the invention has reference to extensible handles—such, for instance, as are used upon shovels and analogous implements for handling coal, and also admitting of general use in instances where longitudinal cylindrical handles are employed. The length of the handles can be changed by the operator at comparatively short intervals.

SELF-FASTENING COTTON-MARKER.—G. W. LONG, Lindsay, Ind. Ter. This invention pertains to improvements in cotton markers, its object being to provide a device which will be self-fastening and one which is simple, cheap, and efficient, one which will remain in place when once attached to a bale of cotton, etc.

MARINE VESSEL.—J. E. JOHNSON, Ishpeming, Mich. The object of this invention is to provide means for propelling marine vessels which will at the same time decrease the resist-

ance offered by the hull to this propulsion. The inventor provides peculiarly-arranged propeller-shafts mounted diagonally on the vessel with respect to water-line and carrying propellers at their lower ends, so that upon the rotation of the shafts the propellers exert a combined lifting and propelling force on the hull, causing it to displace less water, and enabling it to be driven with less resistance.

GARMENT-SUPPORTER.—H. F. NILES, Chicago, Ill. In this case the invention pertains to supports for garments, and more particularly to belt-suspenders for trousers. Its principal objects are to provide a concealed support for such garments as hip-trousers which shall be effective, comfortable, and readily adjustable to the wearer and garment.

DISPLAY DEVICE FOR MILLINERY ARTICLES.—H. SILBERMAN, New York, N. Y. The invention has reference more especially to devices for displaying millinery articles, as ladies' hats and the like, in stores and show-windows and other places; and one of the principal objects thereof is to provide a device of this class which is comparatively inexpensive to manufacture, besides being thoroughly reliable for its purpose and possessing the capacity for long and continued service.

RAZOR-BLADE HOLDER.—J. H. HUNT, Massillon, Ohio. The purpose of the improvement is to provide a readily-operated holder for the blades of safety-razors when it is necessary to hone or strop the same, and, furthermore, to so construct the holder that the blade can be quickly and conveniently introduced into the holder or removed and held firmly between the jaws of the holder during the sharpening process without the use of set-screws or their equivalents.

RAZOR-STROP.—G. W. COLLINS, St. Joseph, Mo. Mr. Collins has found in his experience that many persons who use razors constantly injure them by an improper use of the ordinary swinging strop. The object of the invention is to construct a strop in such a manner that this cannot be done. He avoids the disadvantages of those stropps which have been formed of rigidly-connected straps that could not be adjusted with respect to each other or the supporting means employed.

COMBINED CIGAR CUTTER AND LIGHTER.—W. H. CRAWFORD, Cliftonforge, Va. The invention is an improvement in combined cigar cutters and lighters. The device is entirely automatic in its operation, performs its cycle of movements in proper sequence and always returns the burner into position under the extinguishing-hood, thus preventing waste of fuel from failure to extinguish the flame.

DEVICE FOR TEACHING PENMANSHIP.—R. W. MANUM, Minneapolis, Minn. An en-

velop is employed for containing used and unused practice-sheets to be used by pupils, and means for attaching to the back of envelop a plurality of copy-slips having samples to be followed in any order when practicing examples given. Back of envelop is utilized as a writing-base, upon which practice-sheets are placed. As each line of a practice-sheet is filled out the sheet may be pushed forwardly to temporarily conceal such lines and to bring next succeeding line adjacent to lower edge of the copy-sheet being followed, until all lines of the practice-sheet have been utilized, thus preventing mistakes in copying their writing instead of the exercise on the slip.

UMBRELLA ATTACHMENT.—MARGARET A. BRUNNER, New York, N. Y. In using the device the umbrella is stood near the person and a portion of his garment at a convenient point is placed between inwardly-projecting teeth, whereupon the body of a tassel is slid in the direction to lock the claw to the garment. Rising without noticing the umbrella it will tug at the garment as he moves and he will be apprised that the article is forgotten. It has substantially the appearance of an ordinary umbrella tassel.

COMPUTING DEVICE.—G. M. BROWN, Otto, N. Y. The invention refers to a device for rapidly determining the value of a certain line of goods at a given price without mathematical calculation, and has for its object to produce a device of this character which will have a very large range both in respect to the prices and quantities, which will be very compact in structure and which will be so simple as to render mistakes impossible.

PIPE-WRENCH.—L. V. REMON, San Bernardino, Cal. This wrench is designed especially for use in oil-fields, as in the putting down of pipe-lines. The invention is simple in construction yet efficient in operation, and no complicated mechanism forms part of the wrench. The handles are easily detached. Hence the wrench may be used in a limited space, and when the pipes are properly seated and started power may be used to turn it by means of a belt engaging the wheel-sections. The sections are removable.

HOSE-COUPING.—M. L. SCANLON, J. B. SCANLON and A. A. ARNOLD, Gallon, Ohio. In this patent the invention has reference to means for rendering hose and pipe couplings water, air, and steam tight. The object had in view by the inventors is the provision of a coupling of this character which shall not only be adapted for effecting an improved coupling of the parts, but be simple of construction and easy to operate.

LINE-FASTENER.—D. W. ROBBINS, New York, N. Y. This device is an improvement for securing the ends of and taking up the slack

of clothes-lines or the like, the object being to provide one that will be simple and inexpensive in construction and by means of which the slack of the line may be easily taken up and secured.

CONCRETE-BLOCK MOLD.—J. McL. PATTISON, Terre Haute, Ind. The invention relates to molds more particularly intended for use in the manufacture of concrete into blocks commonly used in place of ordinary brick and heavy stone blocks, and the inventor's object is to obviate certain objections to similar molds as now constructed, such as with some thereof the block must be removed by lifting or lowering action from the mold and with other forms there is much liability of marring the corners, etc., of the block when removing the mold from the block.

LUNA FOR HOLDING THE HOST.—H. F. NEHR, New York, N. Y. One purpose of the invention is to construct a luna in which the host is visible from the front and the back and wherein when the luna is opened the host or waiter will be so supported on the back member of the luna that it can be readily removed by the officiating divine.

FOLDING BABY-CARRIAGE AND CRADLE.—I. ANDREWS, New York, N. Y. The purpose here is to provide a construction which will permit the carriage to be compactly folded when not required, and to provide a construction which permits the carriage body being given a rocking motion, adapting it for use as a cradle, and also to so construct the conveyance that it will be simple, durable, and capable of convenient and expeditious operation.

V-BLOCK.—R. BLAZER, New York, N. Y. The object of this invention is to provide a V-block with an attachment enabling a shaft to be drilled transversely with absolute certainty and to render the attachment adjustable to shafts of various diameters. This he attains by providing a peculiar gage-bar adapted to lie over the block on the top of the shaft and connected with the block by means of slides mounted thereon. In connection with the block he uses a support having certain peculiar connection with the block, enabling its position to be adjusted at will.

ATTACHMENT FOR CHAIRS.—VIRGINIA M. HOLLYDAY, Baltimore, Md. This attachment is for chairs for facilitating conversation between persons of impaired hearing. Speaking-tubes are applied to a double chair or seat, which is preferably of the vis-a-vis type, in such manner that persons seated on opposite sides of the central support between the seats may converse by means of the tubes while supported comfortably and even while their hands may be used for work, since they are not required to support a mouthpiece or ear-tube.

SUPPORT FOR HOISTING DEVICES.—L. GREENEY, New York, N. Y. The object of this invention is to provide a support for hoisting devices, arranged to form a permanent part of the building, to permit convenient attachment and support of the hoisting-tackle employed for hoisting pianos, safes, furniture, and other heavy articles up to a window and through it into a room of the building, and also for use by painters and other mechanics for supporting scaffolds, etc.

COIL-SPRING.—E. HOGAN, Portland, Ore. Some of the many advantages of Mr. Hogan's invention are, it is made all complete with loops, hooks, eyes, snaps, rings, etc., of one unbroken piece of rod or wire; it has four rods or wires, two from each end, passing through the coil to support it, and as they are fastened around last coil opposite each other the strain or tension is the same from each end on two sides of spring, and it gives strength, durability, and efficiency with economy in construction.

EGG-CARRIER.—N. H. CLARK and R. L. CLARK, Munnsville, N. Y. The invention provides a carrier whose body-section consists of a receptacle having partitions forming a series of pockets, each adapted to receive an egg. The cover for the package is in the form of a tray, together with a locking device for the cover, forming a portion of the carrier body, which device holds the tray-cover in place during transportation, whereby upon releasing the device and inverting the carrier eggs will be received by the tray and when the carrier body is removed from said tray-cover the latter will continue to act as a receptacle for the contents of the carrier.

PIANO-REPAIRER'S TOOL.—S. M. KING, Marion, Ind. In this case the invention is an improvement in devices for use by piano-repairers, and has for an object to provide a simple construction for use in polishing and cleaning rust from the tune-pins and that portion of the piano-strings which is coiled around the pins and becomes rusted when the pins rust.

Heating and Lighting.

AIR-HEATING SYSTEM.—F. S. LAMSON, Washington, D. C. Mr. Lamson provides a heat receiving and radiating medium; regulates fresh air supply and retards its movement from radiator to receive desired temperature before escaping; superheats mixed gas and air in the burner before combustion and air furnished exterior to the flame; regulates amount of gas used and air heated by opening and closing the register; provides ingress of cool and egress of heated air through the one register-plate; provides continuing flame when register is closed, from which burners may be lighted upon opening of and extinguished by

the closing of the register; prevents escape of gas when the flame is not burning; and incloses the system to conserve and utilize the heating power of the fuel.

RANGE CONSTRUCTION.—M. F. ALLEN, Nashville, Tenn. This invention relates to improvements in the construction of ranges, the bodies of which are formed of steel or other metal. The construction of the stove or range is greatly simplified, and yet the strength and durability are increased. Further, the inventor is enabled to add to the range a hot-water reservoir by the expenditure of but a nominal amount of labor and material.

Household Utilities.

WINDOW-BLIND SLAT-FASTENER.—M. J. COOGAN, Port Chester, N. Y. In this instance the invention pertains to improvements in window-blinds, the object being to provide a simple and novel means whereby the upper and lower sets of slats will be simultaneously operated and locked in closed position or at any desired opening.

Machines and Mechanical Devices.

ORE-CONCENTRATOR.—G. M. WHITNEY, Lawson, Col. The invention refers more especially to that class of ore-concentrators in which an inclined reciprocating bed or table is employed over which pulverized quartz or sand containing mineral is sorted by gravity and discharged therefrom. One of the principal objects is to provide an apparatus in which the quartz may be subjected to such action as to liberate all the minerals without losing the fine particles of minerals known as "slimes," thus making the separation complete at one operation and discharging the ore automatically.

MILL.—H. A. HOWARD, Sherburne, N. Y. The object of this invention is to overcome the disadvantage in "attrition-mills" where the discharge is clogged, not only causing the mill to drive hard, but also to heat, and therefore injure, the material to be ground. To attain this end Mr. Howard provides a peculiar clearing member or members attached to and rotating with the grinding-heads and located outward from their peripheries, by which means to produce peripheral air-currents, tending to disclose the accumulations referred to and also tending to mechanically scrape or clear away the accumulations.

CONCRETE-BLOCK MACHINE.—J. A. BLAKE and J. KENRICH, Wolcott, Ind. In this machine a circular series of mold-boxes is arranged and to one side of the same there are mounted upper and lower press-heads between which the mold-boxes are adapted to be brought in succession. Suitable operating devices cause the press-heads at the proper time to move respectively against the top and bottom of the mold-box. The mold-boxes and core-blocks employed herewith employ novel features looking to the quick formation of the concrete block and its removal when finished.

TYPE-WRITING MACHINE.—J. A. HAGERSTROM, New York, N. Y. One of the purposes of the invention is to provide a construction of type-levers and a manner of pivoting them whereby each type lever or bar will have an extended bearing, insuring accuracy in printing action and stability in all positions, the bearings being so constructed that while extended the type bars or levers can be arranged the conventional distance apart, all striking at a common center.

GLASS-WORKING MACHINE.—J. NORTH, Lancaster, Ohio. The invention relates to machines for producing glass articles, and more particularly of those for drawing tubes and cylinders. The means employed results in the production of a tube of fixed diameter and by virtue of the constancy of speed secured by a controller said tube will be of uniform quality. The machine is exceedingly simple and convenient to operate.

TYPE-DISTRIBUTING MECHANISM.—H. C. HENRIEL, Chicago, Ill. This improvement insures exact registry of pockets, and consequently rapid and reliable type distribution. The mechanism gives the moving part of the type-distributing mechanism not only its usual step-by-step movement from pocket to pocket, but one or more additional and very slight movements when pocket is reached, so that if when moving parts halt at a pocket registry is not then exact a slight additional movement or movements is given to moving part, whereby to bring pockets into exact registry. These additional movements are necessarily minute and the interval is arranged to be sufficient to allow type to drop freely.

Prime Movers and Their Accessories.

ROTARY EXPLOSION-ENGINE.—P. BARTOLETTI, Brownsville, Pa. In the present patent the object of the invention is the provision of a new and improved rotary explosion-engine arranged to give impulses in quick succession to the piston-heads of the engine with the view to impart a continuous, powerful, and uniform rotary motion to the piston.

STEAM-VALVE.—J. D. AUSTIN and E. N. AUSTIN, Campbell Hill, Ill. The invention pertains to improvements in valves for controlling the admission of steam or other motive agent to an engine-cylinder, the object being to provide a valve of novel and simple construction and by the operation of which the ports leading to the cylinder will remain entirely open until the piston nearly completes its movement, thus resulting in an economy of power.

Pertaining to Recreation.

ARTIFICIAL BAIT.—J. L. ACKERMAN, Monticello, Ind. The invention contemplates constructing an artificial bait with a body comprising two separate sections fitting face to face, together with means for securing said sections. Sections of bait may be made of wood or other material with a plate held between and provided with hooks for securing the fish-hooks. Different forms of wire devices in connection with one of the bait sections are adapted to be held in grooves or otherwise in the body sections and having portions to which the fish-hooks may be connected. The invention comprehends use of sectional body with interposed device—such as the plate or wires for securing the fish-hooks.

Pertaining to Vehicles.

WHEEL.—G. L. HINSCH, Waverly, Iowa. The invention refers to improvements in wheels for vehicles—such as motor-cars, automobiles, machinery-wheels, and pulleys, and the like—the object being to provide a wheel with a spring-yielding hub, so as to relieve the vehicle, machinery, or pulley from undue shock and jar while in motion or while making sudden stops or starts and also obviating the use of pneumatic tires on vehicle-wheels.

DESIGN FOR A PLATE.—C. E. ZIEGLER, Limoges, Haute Vienne, France. This beautiful design gives the plate a circular form. The surface or top edge presents a slightly raised scroll work of six sections, each of which contributes to an outer edge of graceful bow-shaped curves.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. In every case it is necessary to give the number of the inquiry.

MUNN & CO.

Marine Iron Works, Chicago. Catalogue free.

Inquiry No. 7827.—Wanted, address of maker of machinery for the manufacture of rubber-cored golf balls and pneumatic golf balls.

"U. S." Metal Polish, Indianapolis. Samples free.

Inquiry No. 7828.—For manufacturers of machines to make little teeth on sockets, for hand and machine power.

WANTED.—Purchaser for Monasite, Molybdenite and Wolfram, Apply Monasite, Box 173, New York.

Inquiry No. 7829.—For manufacturers of tools for filing saws, etc.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 7830.—For the makers of special nuts drop-foreged.

The celebrated "Hornaby-Akroyd" Patent Safety Oil Engine is built by the De La Verne Machine Company, Foot of East 124th Street, New York.

Inquiry No. 7831.—For manufacturers of steel tubing.

WANTED.—Ideas regarding patentable device for water well pump or mud-lug bottle. Address Adhesive, P. O. Box 77, New York.

Inquiry No. 7832.—For manufacturers of machinery to wind base balls.

Metal Novelty Works Co., manufacturers of all kinds of light Metal Goods, Dies, and Metal Stampings our Specialty. 42-47 S. Canal Street, Chicago.

Inquiry No. 7833.—For manufacturers of devices designed to prevent smoke where shavings and sawdust are used for fuel.

Lithographing adds solidity and strength to your business stationery. Letterheads, \$3 per 1,000. Stilwell, 709 Pine Street, St. Louis.

Inquiry No. 7834.—For manufacturers of machines to pare potatoes in large quantities.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools and wood shre products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 7835.—For Canadian manufacturers of coil cars.

Inventors and Manufacturers.—I design and make drawings for all kinds of Tools, Dies, special Labor-saving Machines, and estimate cost of same.

J. L. Pomeroy, 81 Juniper St., Lockport, N. Y.

For Sale or to Manufacture on Royalty.—Patent No. 766,976. Support for Press Drills. No agents. For information or model apply F. P. Shek, 35 Myrtle Ave., Brooklyn, N. Y.

Inquiry No. 7837.—Wanted, addresses of parties making metal button-making machines, machines for blading, polishing and cleaning cutlery goods; also factories making watches, spectacles, photographic materials and novelties.

Inquiry No. 7838.—For manufacturers of electric hand portable drilling machines, also of air drills.

Inquiry No. 7839.—For manufacturers of perforated music for mechanical piano player.

Inquiry No. 7840.—For manufacturers of stage are lamps and accessories.

Inquiry No. 7841.—For parties using willow wood in diameters up to 2 1/2 inches.

Inquiry No. 7842.—For manufacturers of machinery for making banana flour.

Inquiry No. 7843.—For manufacturers of Portland cement containing no oxide of iron.

Inquiry No. 7844.—For manufacturers of transferable designs; also dealers in chemicals and drugs.

Inquiry No. 7845.—For addresses of hardwood lumber companies.

Inquiry No. 7846.—For manufacturers of small turbine water wheels.

Inquiry No. 7847.—For manufacturers of coffee roasters that will roast or cook 50 pounds of coffee and 40 pounds of sugar until the sugar is burned into the coffee.



HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication. References to former articles or answers should give date of paper and page or number of question. Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Writers. Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each. Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9884) E. E. W. asks: In corresponding with an electrical dealer about hand-power for running a 75-watt dynamo, he said that it could not be run by hand-power, it was too large. This dynamo at 1,400 R. P. M. will furnish 15 to 20 volts; at 2,000 R. P. M. will furnish 40 to 50 volts. In a circular I have there is a 75-watt dynamo advertised. This dynamo will furnish an alternating and direct current at the same time or separate. It will run as a motor on a direct current and at the same time furnish an alternating current to light lamps by. In all other respects it is the same except in design. The questions in my mind are why cannot the first dynamo be run by hand-power if the one can that I last described? Does it take more power to run a dynamo as you increase the amount of current or the voltage? If a dynamo is run at a higher speed than it was designed to run, would there be a higher voltage or amperage? A 75-watt dynamo can be run by hand, by one-man power, for awhile. It is one-tenth horse-power. And a strong man can exert more power than that for a short time. It matters not how the 75 watts are made up—1 ampere at 75 volts, or 3 amperes at 25 volts, or any combination which gives 75 for a product. Power is in watts, and these are the product of volts and amperes. If the speed of a dynamo is increased the volts are increased, but the amperes remain the same. All the amperes flow which the resistance allows to flow. The volts depend upon the rate of cutting lines of force by the revolving armature. This is increased by increased speed. But if 1,400 turns per minute give 15 volts, 2,000 turns per minute can only give 22 volts, and not 40 volts as you give it.

(9885) E. L. D. asks: In your column "Answers to Inquiries" will you oblige a 45-year reader of the SCIENTIFIC AMERICAN by stating scientists' explanation of the great weight of the earth? Astronomers say the whole weight is 5 1/2 times that of water; viz., about 344 pounds per cubic foot. Marble and the densest granite rarely exceed 180 pounds per cubic foot. By far the largest part of the earth known to man is much less in weight than granite; for example, water, earths of all kinds, coal, all woods, etc. If astronomers are correct, a few hundred miles down and thence to the center of the earth there must be great density of matter. A. It is true that the average density of the materials on the earth's surface is not greater than three times that of water. The weight of a cubic foot of such materials then is not far from 180 pounds per cubic foot. Your inference is the only possible one, that the interior of the earth is much heavier than the surface portions. Nor is this any different from what would be expected, if once the earth were fluid. At that time the heavier substances sank to the bottom of the fluid mass, and are at present nearer the center of the earth.

(9886) B. E. H. asks: 1. Imagine a tunnel through the center of the earth. If an iron ball was dropped into it, where would the ball come at rest? A. If there was nothing to impede or deflect a falling ball from its path down a hole drilled through the center of the earth, it would go to the surface on the opposite side and then fall back again to its starting point, and never come to rest. If only the resistance of the air were taken into account, the ball would fall to and fro a less distance each time, and ultimately come to rest at the center of the earth. 2. Please give me the formula for making a sal-ammoniac battery. A. For an ordinary LeClanche cell dissolve four or five ounces of sal-ammoniac in water enough for the cell and pour it in.

(9887) H. D. G. asks: Desire an opinion on a question that probably is an old one, that certainly admits of a correct solution. If it were twice as cold as two degrees above zero, how cold would it be? Fahr. computation. A. Degrees measured from the ordinary zero of a thermometer do not express the relative amount of heat or cold. To do this the degrees must be counted from the absolute zero, which in the Fahrenheit scale is 459 degrees below ordinary zero. In this scale 2 degrees above the common zero is 461 degrees above absolute zero. Twice as cold as this, or better, half as hot, is 230.5 degrees above absolute zero. It would be expressed as 230.5 degrees absolute Fahr.

Wood-working Machinery

For ripping, cross-cutting, planing, grooving, boring, scroll-sawing, edge moulding, mortising, for working wood in any manner. Send for catalogue A. The Seneca Falls M'g Co., 100 Water St., Seneca Falls, N. Y.



Engine and Foot Lathes

MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. BEST WORKMANSHIP. CATALOGUE FREE. SEBASTIAN LATHE CO., 120 Culvert St., Cincinnati, O.

Foot and Power and Turret Lathes, Planers, Shapers, and Drill Presses

SHEPARD LATHE CO., 10 W. 34 St., Cincinnati, O.

GIANT STEAM SHOVELS

Toledo, Ohio, U.S.A. The Vulcan Iron Works Co.

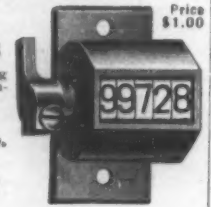
Veeder Counters

to register reciprocating movements of revolutions. Cut full size.

Booklet Free

VEEDER MFG. CO., Hartford, Conn.

Cyclometers, Odometers, Tachometers, Counters and Fine Castings.



Nickel Plate Road Again Selling Colonist Tickets to the Pacific Coast.

Extremely low rate tickets on sale daily February 15 to April 1 to Pacific Coast and other points in the Far West. Tickets good on any of our trains and in tourist sleepers. For full information write A. W. ECKLESTON, D. P. A., 26 Broadway, New York City.

\$80 to \$175 Per Month

For Firemen and Brakemen, experience unnecessary. Instructions by mail at your home. High wages guaranteed. Rapid promotion. We assist you in securing a position soon as competent. Send today. Full particulars at once. Enclose stamp.

National Railway Training School, Inc. Room 630 Hudson Block MINNEAPOLIS, MINN.

A. W. Taber.

Manufacture Established 1861.

Lead-Colored Slate Pencils, Rubber Bands, Erasers, Ink, Penholders, Rulers, Water Colors, Improved Calculating Rules. Send for descriptive Circular.

44-60 East 23d Street, New York, N. Y. Grand Prize, Highest Award, St. Louis, 1904.

Mustard & Company

GENERAL IMPORTERS AND COMMISSION AGENTS

Plumbing Supplies, Pipes and Scales. The largest Hardware Machinery and Tool House in China.

94 NANKING ROAD SHANGHAI, CHINA

Automatic Water Supply

Most economical, reliable and efficient. If you have running water the Niagara engine will deliver 100 feet for each foot full obtainable from spring, brook, or river, delivered to any distance. Write for catalogue.

Niagara Hydraulic Engine Co. 140 Nassau St., N. Y.

French Motors for Lighting Plants

The "ARTER" is the best French motor on the market for lighting houses, hotels, etc. Small, compact, simple and safe in operation. Motive power of 1/2, 1, 2 and 4 cylinders. Great power for small engines. Easy running. Write for illustrated Price List.

ASTER COMPANY 1401 Broadway NEW YORK CITY

A Loose Leaf Book

PERFECTLY Flat-Opening AND Self-Indexing

Most convenient for reference. Loose leaf books, pocket ledgers, motor books, composition books, etc. and all forms of books which should be kept in convenient, accessible form. Under the "Loose Leaf" system, books are bound in full, genuine, flexible, black leather, are perfectly flat opening and sheets may be instantly inserted or removed from any part.

The following show sent postpaid on receipt of price:

USE	No.	Binding	Size of Pages	Number of Pages	Price
Account Book	410	1/2	9 x 4	20	\$0.45
Check Book	412	1/2	9 x 4	20	\$0.45
Card Book	414	1/2	9 x 4	20	\$0.45
Index Book	416	1/2	9 x 4	20	\$0.45
Index Book	418	1/2	9 x 4	20	\$0.45
Index Book	420	1/2	9 x 4	20	\$0.45
Index Book	422	1/2	9 x 4	20	\$0.45
Index Book	424	1/2	9 x 4	20	\$0.45
Index Book	426	1/2	9 x 4	20	\$0.45
Index Book	428	1/2	9 x 4	20	\$0.45
Index Book	430	1/2	9 x 4	20	\$0.45
Index Book	432	1/2	9 x 4	20	\$0.45
Index Book	434	1/2	9 x 4	20	\$0.45
Index Book	436	1/2	9 x 4	20	\$0.45
Index Book	438	1/2	9 x 4	20	\$0.45
Index Book	440	1/2	9 x 4	20	\$0.45
Index Book	442	1/2	9 x 4	20	\$0.45
Index Book	444	1/2	9 x 4	20	\$0.45
Index Book	446	1/2	9 x 4	20	\$0.45
Index Book	448	1/2	9 x 4	20	\$0.45
Index Book	450	1/2	9 x 4	20	\$0.45
Index Book	452	1/2	9 x 4	20	\$0.45
Index Book	454	1/2	9 x 4	20	\$0.45
Index Book	456	1/2	9 x 4	20	\$0.45
Index Book	458	1/2	9 x 4	20	\$0.45
Index Book	460	1/2	9 x 4	20	\$0.45
Index Book	462	1/2	9 x 4	20	\$0.45
Index Book	464	1/2	9 x 4	20	\$0.45
Index Book	466	1/2	9 x 4	20	\$0.45
Index Book	468	1/2	9 x 4	20	\$0.45
Index Book	470	1/2	9 x 4	20	\$0.45
Index Book	472	1/2	9 x 4	20	\$0.45
Index Book	474	1/2	9 x 4	20	\$0.45
Index Book	476	1/2	9 x 4	20	\$0.45
Index Book	478	1/2	9 x 4	20	\$0.45
Index Book	480	1/2	9 x 4	20	\$0.45
Index Book	482	1/2	9 x 4	20	\$0.45
Index Book	484	1/2	9 x 4	20	\$0.45
Index Book	486	1/2	9 x 4	20	\$0.45
Index Book	488	1/2	9 x 4	20	\$0.45
Index Book	490	1/2	9 x 4	20	\$0.45
Index Book	492	1/2	9 x 4	20	\$0.45
Index Book	494	1/2	9 x 4	20	\$0.45
Index Book	496	1/2	9 x 4	20	\$0.45
Index Book	498	1/2	9 x 4	20	\$0.45
Index Book	500	1/2	9 x 4	20	\$0.45
Index Book	502	1/2	9 x 4	20	\$0.45
Index Book	504	1/2	9 x 4	20	\$0.45
Index Book	506	1/2	9 x 4	20	\$0.45
Index Book	508	1/2	9 x 4	20	\$0.45
Index Book	510	1/2	9 x 4	20	\$0.45
Index Book	512	1/2	9 x 4	20	\$0.45
Index Book	514	1/2	9 x 4	20	\$0.45
Index Book	516	1/2	9 x 4	20	\$0.45
Index Book	518	1/2	9 x 4	20	\$0.45
Index Book	520	1/2	9 x 4	20	\$0.45
Index Book	522	1/2	9 x 4	20	\$0.45
Index Book	524	1/2	9 x 4	20	\$0.45
Index Book	526	1/2	9 x 4	20	\$0.45
Index Book	528	1/2	9 x 4	20	\$0.45
Index Book	530	1/2	9 x 4	20	\$0.45
Index Book	532	1/2	9 x 4	20	\$0.45
Index Book	534	1/2	9 x 4	20	\$0.45
Index Book	536	1/2	9 x 4	20	\$0.45
Index Book	538	1/2	9 x 4	20	\$0.45
Index Book	540	1/2	9 x 4	20	\$0.45
Index Book	542	1/2	9 x 4	20	\$0.45
Index Book	544	1/2	9 x 4	20	\$0.45
Index Book	546	1/2	9 x 4	20	\$0.45
Index Book	548	1/2	9 x 4	20	\$0.45
Index Book	550	1/2	9 x 4	20	\$0.45
Index Book	552	1/2	9 x 4	20	\$0.45
Index Book	554	1/2	9 x 4	20	\$0.45
Index Book	556	1/2	9 x 4	20	\$0.45
Index Book	558	1/2	9 x 4	20	\$0.45
Index Book	560	1/2	9 x 4	20	\$0.45
Index Book	562	1/2	9 x 4	20	\$0.45
Index Book	564	1/2	9 x 4	20	\$0.45
Index Book	566	1/2	9 x 4	20	\$0.45
Index Book	568	1/2	9 x 4	20	\$0.45
Index Book	570	1/2	9 x 4	20	\$0.45
Index Book	572	1/2	9 x 4	20	\$0.45
Index Book	574	1/2	9 x 4	20	\$0.45
Index Book	576	1/2	9 x 4	20	\$0.45
Index Book	578	1/2	9 x 4	20	\$0.45
Index Book	580	1/2	9 x 4	20	\$0.45
Index Book	582	1/2	9 x 4	20	\$0.45
Index Book	584	1/2	9 x 4	20	\$0.45
Index Book	586	1/2	9 x 4	20	\$0.45
Index Book	588	1/2	9 x 4	20	\$0.45
Index Book	590	1/2	9 x 4	20	\$0.45
Index Book	592	1/2	9 x 4	20	\$0.45
Index Book	594	1/2	9 x 4	20	\$0.45
Index Book	596	1/2	9 x 4	20	\$0.45
Index Book	598	1/2	9 x 4	20	\$0.45
Index Book	600	1/2	9 x 4	20	\$0.45
Index Book	602	1/2	9 x 4	20	\$0.45
Index Book	604	1/2	9 x 4	20	\$0.45
Index Book	606	1/2	9 x 4	20	\$0.45
Index Book	608	1/2	9 x 4	20	\$0.45
Index Book	610	1/2	9 x 4	20	\$0.45
Index Book	612	1/2	9 x 4	20	\$0.45
Index Book	614	1/2	9 x 4	20	\$0.45
Index Book	616	1/2	9 x 4	20	\$0.45
Index Book	618	1/2	9 x 4	20	\$0.45
Index Book	620	1/2	9 x 4	20	\$0.45
Index Book	622	1/2	9 x 4	20	\$0.45
Index Book	624	1/2	9 x 4	20	\$0.45
Index Book	626	1/2	9 x 4	20	\$0.45
Index Book	628	1/2	9 x 4	20	\$0.45
Index Book	630	1/2	9 x 4	20	\$0.45
Index Book	632	1/2	9 x 4	20	\$0.45
Index Book	634	1/2	9 x 4	20	\$0.45
Index Book	636	1/2	9 x 4	20	\$0.45
Index Book	638	1/2	9 x 4	20	\$0.45
Index Book	640	1/2	9 x 4	20	\$0.45
Index Book	642	1/2	9 x 4	20	\$0.45
Index Book	644	1/2	9 x 4	20	\$0.45
Index Book	646	1/2	9 x 4	20	\$0.45
Index Book	648	1/2	9 x 4	20	\$0.45
Index Book	650	1/2	9 x 4	20	\$0.45
Index Book	652	1/2	9 x 4	20	\$0.45
Index Book	654	1/2	9 x 4	20	\$0.45
Index Book	656	1/2	9 x 4	20	\$0.45
Index Book	658	1/2	9 x 4	20	\$0.45
Index Book	660	1/2	9 x 4	20	\$0.45
Index Book	662	1/2	9 x 4	20	\$0.45
Index Book	664	1/2	9 x 4	20	\$0.45
Index Book	666	1/2	9 x 4	20	\$0.45
Index Book	668	1/2	9 x 4	20	\$0.45
Index Book	670	1/2	9 x 4	20	\$0.45
Index Book	672	1/2	9 x 4	20	\$0.45
Index Book	674	1/2	9 x 4	20	\$0.45
Index Book	676	1/2	9 x 4	20	\$0.45
Index Book	678	1/2	9 x 4	20	\$0.45
Index Book	680	1/2	9 x 4	20	\$0.45
Index Book	682	1/2	9 x 4	20	\$0.45
Index Book	684	1/2	9 x 4	20	\$0.45
Index Book	686	1/2	9 x 4	20	\$0.45
Index Book	688	1/2	9 x 4	20	\$0.45
Index Book	690	1/2	9 x 4	20	\$0.45
Index Book	692	1/2	9 x 4	20	\$0.45
Index Book	694	1/2	9 x 4	20	\$0.45
Index Book	696	1/2	9 x 4	20	\$0.45
Index Book	698	1/2	9 x 4	20	\$0.45
Index Book	700	1/2	9 x 4	20	\$0.45
Index Book	702	1/2	9 x 4	20	\$0.45
Index Book	704	1/2	9 x 4	20	\$0.45
Index Book	706	1/2	9 x 4	20	\$0.45
Index Book	708	1/2	9 x 4	20	\$0.45
Index Book	710	1/2	9 x 4	20	\$0.45
Index Book	712	1/2	9 x 4	20	\$0.45
Index Book	714	1/2	9 x 4	20	\$0.45
Index Book	716	1/2	9 x 4	20	\$0.45
Index Book	718	1/2	9 x 4	20	\$0.45
Index Book	720	1/2	9 x 4	20	\$0.45
Index Book	722	1/2	9 x 4	20	\$0.45
Index Book	724	1/2	9 x 4	20	\$0.45
Index Book	726	1/2	9 x 4	20	\$0.45
Index Book	728	1/2	9 x 4	20	\$0.45
Index Book	730	1/2	9 x 4	20	\$0.45
Index Book	732	1/2	9 x 4	20	\$0.45
Index Book	734	1/2	9 x 4	20	\$0.45
Index Book	736	1/2	9 x 4	20	\$0.45
Index Book	738	1/2	9 x 4	20	\$0.45
Index Book	740	1/2	9 x 4	20	\$0.45
Index Book	742	1/2	9 x 4	20	\$0.45
Index Book	744	1/2	9 x 4	20	\$0.45
Index Book	746	1/2	9 x 4	20	\$0.45
Index Book	748	1/2	9 x 4	20	\$0.45
Index Book	750				

Wood-working Machinery

For ripping, cross-cutting, mitering, grooving, boring, scroll-sawing, edge-molding, mortising, for working wood in any manner. Send for catalogue. A. The Seneca Falls Mfg Co., 436 Water St., Seneca Falls, N. Y.



Engine and Foot Lathes

MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. BEST WORKMANSHIP. CATALOGUE FREE. SEBASTIAN LATHE CO., 120 Culvert St., Cincinnati, O.

Foot and Power and Turret Lathes, Planers, Shapers, and Drill Presses

SHEPARD LATHE CO., 38 W. 24 St. Cincinnati, O.

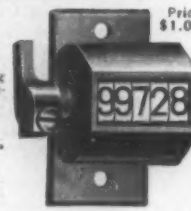
GIANT STEAM SHOVELS
Toledo, Ohio, U.S.A.
The Vulcan Iron Works Co.
Valencia Place

Veeder Counters

to register reciprocating movements or revolutions. Cut full size.

Booklet Free
VEEDER MFG. CO.
Hartford, Conn.

Cyclometers, Odometers, Tachometers, Counters and Fine Counters.



Nickel Plating Road Again Selling Colonist Tickets to the Pacific Coast.

Extremely low rate tickets on sale daily February 15 to April 7 to Pacific Coast and other points in the Far West. Tickets good on any of our trains and in tourist sleepers. For full information write A. W. ECKLESTON, D. P. A., 38 Broadway, New York City.

\$80 to \$175 Per Month
For Firemen and Brahmans, experience unnecessary. Instructions by mail at your home. High wages guaranteed. Rapid promotion. We assist you in securing a position soon as competent. Send today. Full particulars at once. Include stamp.
National Railway Training School, Inc.
Room 628 Hudson Bldg.
MINNEAPOLIS, MINN.

A. W. Tabor.
Manufacture Established 1791.
Lead-Colored Pigment Pencils, Rubber Bands, Erasers, Ink, Penholders, Rulers, Water Colors, Improved Calculating Rules.
Send for descriptive Circular.
44-60 East 23d Street, New York, N. Y.
Grand Prize, Highest Award, St. Louis, 1904.

Mustard & Company

GENERAL IMPORTERS AND COMMISSION AGENTS

Plumbing Supplies, Sinks and Scales. The largest Hardware Machinery and Tool House in China

96 NANKING ROAD SHANGHAI CHINA

Automatic Water Supply
Most economical, reliable and efficient. If you have running water the Niagara engine will elevate it to any height. Full details obtainable from spring, brook, or river, delivered by mail. Write for catalogue.
Niagara Hydraulic Engine Co.
140 Nassau St., N. Y.

French Motors for Lighting Plants
The "ASTER" is the best French motor on the market for lighting houses, hotels, etc. Small, compact, simple and safe to operate. Active power alcohol, oil, gas, 1 and 4 cylinders, rated power for small engines. Easy running. Write for Illustrated Price List.
ASTER COMPANY
1591 Broadway NEW YORK CITY

A Loose Leaf Book
PERFECTLY Flat-Opening AND Self-Indexing
Most convenient for loose leaves, booklets, pocket books, motor books, engineering books, etc. Perfectly flat opening and sheets may be instantly inserted or removed from any part.
The following sizes sent postpaid on receipt of price:

USE	No.	Binding	Size of Sheet	Capacity of Cover	Cost
Van Pocket	210	0	6 1/2 x 9 1/2	100	\$0.05
"	410	0	8 1/2 x 11 1/2	100	"
Open Pocket	410	0	8 1/2 x 11 1/2	100	1.00
"	410	0	8 1/2 x 11 1/2	100	1.50
"	410	0	8 1/2 x 11 1/2	100	2.00
"	410	0	8 1/2 x 11 1/2	100	2.50
"	410	0	8 1/2 x 11 1/2	100	3.00
"	410	0	8 1/2 x 11 1/2	100	3.50
"	410	0	8 1/2 x 11 1/2	100	4.00
"	410	0	8 1/2 x 11 1/2	100	4.50
"	410	0	8 1/2 x 11 1/2	100	5.00

39 other sizes carried in stock

Stock selling: Quodette, Unruled, Dotted and Cont. Point Lines, Double Entry Ledger and 4-Column Price-Book Binding.

Send for sample sheets and complete catalogue of our past line's loose-leaf devices on the world.

Stiles & Truett Mfg. Co., 4902 Lucile Ave., St. Louis

INDEX OF INVENTIONS

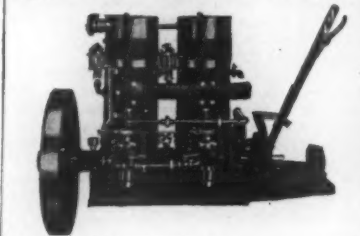
For which Letters Patent of the United States were issued for the Week Ending January 30, 1906.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acid and making same, mercury salts of	811,193
Adding and typewriting machine, combined	811,197
Anchor, H. G. Duns	811,205
Adding device, E. C. Dillworth	811,205
Adjustable bracket, B. H. Spangenberg	811,205
Adjustable washer, J. H. Childer	811,205
Air brake, E. T. Hughes	811,205
Air brake, Starward & Co.	811,205
Air compressing engine, H. E. Clifford	811,205
Air goods, H. F. Kell	811,205
Air goods fabric, H. F. Kell	811,205
Alarm, G. A. Hill	811,205
Alloys, manufacture of nickel-copper, A.	811,205
Alumina, calcination of hydrated, A. R.	811,205
Amusement apparatus, F. J. McCabe	811,205
Anchor, H. G. Duns	811,205
Annunciator, W. B. Horing	811,205
Annunciator, H. M. Olsen	811,205
Arbor, J. Cooper	811,205
Arch, H. Schneider	811,205
Auger-bit knife, F. T. Wyckoff	811,205
Automobile front axle, F. C. Miller	811,205
Automobile wheel, Wheeler & Hecker	811,205
Automobile, automatic air brake apparatus for, E. Kallisch	811,205
As handle wedge, L. F. Herwig	811,205
Back and chest protector, M. L. Padlock	811,205
Bag frame, E. von Kigen	811,205
Bag frame handle or strap attachment, B. von Eiges	811,205
Bag handle, H. Goldsmith	811,205
Barrel, machine for making, Robert Stave	811,205
G. H. Brown	811,205
Bearing machine, F. A. Baer	811,205
Bearing for spindles of grinding machines, Z. H. Tucker	811,205
Bearing, scale pivot, J. A. Barclay	811,205
Bed, extension, J. H. Hanson	811,205
Bell ringer, pneumatic, J. H. Hanson	811,205
Belt guide, R. H. Knudsen	811,205
Berrelling machine, L. H. Rice	811,205
Billets, machine for feeding tubular, H. C. Rieffel	811,205
Blinder, loose leaf ledger, J. Graves	811,205
Blinder, temporary, J. B. Barlow	811,205
Blinders, automatic locking device for loose leaf, G. T. Dalton	811,205
Blackening machine, shoe, F. H. Brewster	811,205
Block, W. F. Roberts	811,205
Boat, marine, Padberton & Deadman	811,205
Boiler fire box, steam, C. W. Hallings	811,205
Boiler tube, Whyte & Cromley	811,205
Holers, apparatus for maintaining hot water, steam pressure in portable, C. C. Rich	811,205
Bolt coupling, King, W. W. Green	811,205
Bolt machine, J. K. Koons	811,205
Bottle, non-refillable, M. F. Hansen	811,205
Bottle, non-refillable, W. D. Davis	811,205
Bowling alley, F. W. Brinkmeyer	811,205
Bracket for employment on windows, ladders and parapets, adjustable, C. Mills	811,205
Brake mechanism, fluid, L. T. Barlow	811,205
Breaching stay, harness, F. X. Schumacher	811,205
Brick machine, O. Nolan	811,205
Bridge and making the same, J. B. Strauss	811,205
Brook, F. C. Conner	811,205
Brush, fountain, G. L. Becher	811,205
Buffing machine, J. J. Jesman	811,205
Building block mold, W. Forten	811,205
Building block, machine for making, W. Forten	811,205
Bulkhead door, automatic cut-out mechanism for electrically operated, W. B. Cowley	811,205
Bulletin board and rack, W. Kingburg	811,205
Butter cutter, R. J. Woolley	811,205
Button, collar, C. F. Rodgers	811,205
Cab runner, J. W. Brecken	811,205
Candy making machine, G. Fratt	811,205
Canopy, folding, P. A. Pollock	811,205
Canopy, portable, A. Voorhes	811,205
Car coupling, J. K. Vaughn	811,205
Car coupling, J. K. Vaughn	811,205
Car coupling apparatus, G. E. Kelly	811,205
Car coupling, auxiliary, Pennepacker & Laxon	811,205
Car door clean and sealing device, R. C. Sullivan	811,205
Car door, grain, C. L. Robbins	811,205
Car dump, C. C. Hughes	811,205
Car frame, hand, J. Donovan	811,205
Car part, E. I. Dodd	811,205
Car sliding door, railway, F. D. Ackerman	811,205
Car starter, Booth & Wier	811,205
Card case, W. C. Danwell	811,205
Cards, piano machine head for punching, Jacquard, V. E. Boyle	811,205
Carpet, machine for laying, A. L. Robinson	811,205
Carriage top, C. H. Gill	811,205
Cartridge, firearm, F. E. Clot	811,205
Caster, ball bearing, O. C. Kugel	811,205
Caster, ball bearing, O. C. Kugel	811,205
Catafalque, W. J. Gabyrnek	811,205
Cattle guard, Friedman & Graham	811,205
Celium products, treatment of same for the manufacture of, F. L. Stewart	811,205
Cement or plastic block molding press, C. A. Meyers	811,205
Chain, drive, W. H. Gates	811,205
Chain, extensible, E. C. Gipe	811,205
Chair attachment, reclining, M. Fane	811,205
Chair seat, V. A. Taylor	811,205
Chair tip, rocking, F. Lynch	811,205
Chess recorder, L. E. Babst	811,205
Churn, J. G. Smith	811,205
Cigar branding machine, B. Liberman	811,205
Cigar machine, wrapper support, O. Tyberg	811,205
Cigarette machine, F. E. Anderson	811,205
Cleaning device, A. P. Trimm	811,205
Coal screen, E. R. Dickey	811,205
Coaling device, moving train, C. M. Miller	811,205
Coat and hat rack, H. E. Collins	811,205
Coin tray, E. J. Brandt	811,205
Collar and cut shaper, W. B. Heron	811,205
Collar support, adjustable, P. S. Reynolds	811,205
Colter standard and fork attachment, rolling, P. A. Blunkin	811,205
Compans, beam, A. A. Merritt	811,205
Concrete bodies, machine for molding, M. A. Winget, reissue	811,205
Concrete fence post, H. H. Emerson	811,205
Concrete mold, T. M. Emerson	811,205
Confectioner's work table, L. Schendt	811,205
Converter, G. T. Walker	811,205
Converter, H. H. Bucher	811,205
Conveyor, W. B. Johnson	811,205
Conveyor, A. W. F. Steckel	811,205
Conveyor, A. J. Webster	811,205
Conveyor, H. M. Weather	811,205
Conveyor, A. J. Webster	811,205
Conveying scoop, W. Crossley	811,205
Conveying and elevating apparatus, A. J. Webster	811,205
Cup, folding transportation poultry, L. D. Fowler	811,205
Cupping apparatus, F. Jaeger	811,205
Cord fastener, E. M. Constock	811,205
Cord tension alarm, C. Bransgrove	811,205
Cord extracting device, R. D. Kline	811,205
Corn husker, M. H. E. Johnson	811,205
Corset, conformer, C. Munter	811,205

Reliable Marine Motors



Reliability is absolutely the first consideration in a Marine Motor.
Fay & Bowen Motors have an unequalled record for reliability in numberless endurance and heavy weather tests.
Simplicity, durability, power and flexibility. No crank required for starting.
Send for free catalogue of Reliable Motors and perfectly built boats.

Fay & Bowen Engine Company
80 Lake Street Geneva, N. Y., U. S. A.

For Polishing and Sharpening



35,000 "Little Wonders" in every quarter of the globe talk for us. They are "Wonders." We have been in this business three years. Not so had imitations are beginning to appear. Their claims are broad but their results are limited. Don't get fooled. Initiation is the sharpest form of flattery, but we like you to know that it is cheap imitation.
A Warner Little Wonder Facet Water Motor attaches directly to regular threaded faucet or by our Universal Connection to any smooth faucet. Not a turn. Sharpens knives, razors or cutlery of any description, polishes and cleans brass, silver, steel, glass or any metal surface. Furnishes power to operate light machinery of any kind. Useful about the house for a dozen different purposes. Cutlery includes knives, stony wheel, buffing and polishing wheels, pulley wheel and silver and steel polishing compounds. Complete, neatly boxed, \$4.00. Attractive booklet on request, FREE.

WARNER MOTOR CO., Dept. 15, Flatiron Bldg., New York
Mfrs. of Water Motors 1-16 to 10 h. p. Water Pumps and accessories

Electric Supplies and Novelties

Catalogue of 300 pp. free. It's Electric we have it.
OHIO ELECTRIC WORKS, Cleveland, O.
The World's Headquarters for Electric Novelties, Supplies, Books. We Undercut All. Want Agents.

NEW YORK SCHOOL OF AUTOMOBILE ENGINEERS

Incorporated
147 West 54th Street, New York City
Under the personal direction of
PROF. CHAS. E. LITCH, M. E., Ph.D.
School of Engineers, Columbia University
Departments include machine tool and forge shops; assembling and test shops, and every type of motor, also laboratories completely and specially equipped to teach all component parts of automobiles.
Day and Evening Classes.
SPECIAL COURSES FOR OWNERS.

THE PANAMA CANAL IS DESCRIBED

from the engineering standpoint in SCIENTIFIC AMERICAN SUPPLEMENT 1359. Price 10 cents, by mail. Munn & Company, 361 Broadway, New York City, and all newsdealers.

\$250 for an Automobile

The "Success" is just what you have been waiting for. It is an Automobile buggy—light, strong, powerful, speedy, safe and easy to operate. The "Success" is not an experiment—it is thoroughly practical—invented by an engineer with ten years' experience in automobile construction. Over ordinary roads it will run 30 miles on one gallon of gasoline. It's a good hill climber—takes a 30 grade. Speed from 4 to 15 miles per hour. No complicated parts to get out of order.
Orders for Spring delivery should reach us early as orders for March shipment will fix our output facilities. Write for descriptive literature, terms, etc.
"SUCCESS" AUTOMOBILE MFG. CO.
532 De Baliviere Ave. St. Louis, Mo.

THE ARDREY VEHICLE WASHER
(Patented Aug. 15, 1904.)
With the Ardrey Vehicle Washer you can keep your Carriage, Auto, Bus or Delivery Wagon clean, without using your hands or water. Made of solid brass, fits any ordinary wheel. Water constantly forcing itself through the sponge masses. Absolutely impossible to injure the finest finish.
diately removes all dirt and grit.
Prepaid \$2.00. Money back if not satisfactory. Double FREE.
ARDREY VEHICLE WASHER CO., 181 F. Main St., Rochester, N. Y.



THE POSTAL TYPEWRITER CO.'S

FACTORY AT NORWALK, CONN.
Is Equipped to do Experimental Work. Tool Making and Manufacturing. Inventions Developed. Very Best Work Guaranteed. Correspondence Solicited.

THE "BEST" LIGHT

SUPERIOR TO ELECTRICITY TWO CENTS A WEEK

When you are tired of the gas, dirt, and odor of light, get the light that is brighter than electricity or kerosene, and makes and burns its own gas. There is only one. It's the "BEST." It's much cheaper than kerosene. It's made in over 100 beautiful styles. It is an ornament to any home, and every lamp is warranted. Just drop us a postal today and get our catalog and price. Agents wanted Everywhere. Big money in it for you to either use or sell our lamps.
THE BEST LIGHT CO.,
87 E. 8th St., Canton, O.
Owners of Original Patents.

A Sterling Silver Cigar Cutter

that every smoker will be glad to own. No matter in what part of the United States you live we will mail one.

For One Dollar The R. S. Cigar Cutter

postpaid. The R. S. is the handiest and most satisfactory cutter made. Carried in vest pocket. Lasts for years. Ask your jeweller.
Best postpaid to any address on receipt of One Dollar.
F. H. DICKSON, 22 Hay's Bldg., Maiden Lane, N. Y.

RELIABLE MARINE ENGINES

Reliability under all conditions is the characteristic of the "Lamb" Engines. Since from 186 to 100 H. P. in stock. Write for catalogue.
TERRY & CO.
MANUFACTURERS AND ENGINEERS
95 Chambers St., New York
Everything for Boat & Engine

The Berton Valveless Engine

Has no valve in either intake or exhaust. Consequently, it has fewer wearing parts. It has fewer parts to get out of order. It has more power with less weight. It is simpler. It is under perfect control. Runs at any speed. From 2 to 40 H. P. Furnishings for fresh or salt water.
T. P. BERTON & SON
MANUFACTURERS
Front and Pearl Streets, LA CROSSE, WIS., U. S. A.

The Wonder Gasoline Motors

Something New and Up-to-date.
More power for less money than any other machine on the market. No valves, gears, etc., to get out of order. Jump Spark. Our 1 1/2 H. P. motor outfit is a "WONDER." Solid or reversing propeller. Our price will surprise you. Write today. Marine or stationary outfit to suit any requirements up to 5 H. P.
The E. M. Corwell Co., 406 S. 3rd St., ST. LOUIS, N. Y.

STEAM TURBINES — THEIR CONSTRUCTION, OPERATION and Commercial Application.

SCIENTIFIC AMERICAN SUPPLEMENT 1360, 1367, 1368, 1423, 1400, 1447, 1370, 1373. The articles have all been prepared by experts in steam engineering. Price 10 cents each, by mail. Munn & Co., 361 Broadway, New York City, and all newsdealers.

Four-Cycle Motor

Single and double cylinders. Simple and reliable. Best material and workmanship. Not how cheap but how good. They are moderate in price. Write us. Catalogue free.
Grant-Ferris Co., Troy, N. Y.

THE SHOREHAM

WASHINGTON, D. C.

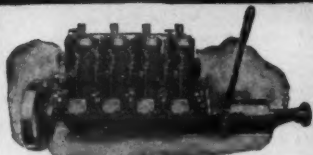
The Leading Fashionable Hotel

METROPOLITAN STANDARD OF EXCELLENCE. ABSOLUTELY MODERN AND HIGH CLASS IN ALL DETAIL. AMERICAN AND EUROPEAN PLAN

JOHN T. DEVINE, PROPRIETOR

SMALLEY

MARINE GAS ENGINES



"It Is Self Starting"

INDIAN RIVER, MICH., October 14, 1905.

SMALLEY MOTOR CO., Bay City, Mich.
Gentlemen—After using the 12 H. P. engine I am pleased to report to you that the engine has proved far beyond my expectations. In all my use of the engine I have never known it to miss an explosion. I have kept actual count of twenty-seven times I have started engine after having made stops at various points along the river and in twenty-six of these twenty-seven times I have never used either starting lever or turned a wheel, simply starting engine by means of the commutator. IT IS SELF-STARTING. Yours truly, CHAS. COYKELL.

Send to each for stamps for complete illustrated catalogue. Address Dept. W.

SMALLEY MOTOR CO., LTD., Bay City, Mich., U. S. A.

Member of the National Ass'n of Engines and Boat Mfrs.

HANG IT

upside down if you like, and it won't spill a drop. Of course the "GEM" Dry Storage Battery, which during the recent New York show was used in all the demonstration runs of the following firms: Ode Motor Works, Berkshire Automobile, York Automobile, etc.

An ideal battery for all kinds of ignition work, small incandescent lights, dental engines, castings, wireless telegraph, small motors, etc. Write for '06 Catalog and trade prices.

Royal Battery Co., 141 Chambers St., N. Y.

Road Freighting Traction Engines



Over 200 in use on Pacific Coast alone. Siberia, Spain, India, Central America, Sandwich Islands have them.

Engines 110 Horse-power. Wood, Coal, or Oil burning. Hauls 50 other grades 5 to 25 per cent. Capacity each car 16 tons.

THE BEST MFG. COMPANY

San Leandro, California

Cable Address: DANBEST. Write for our New Catalogue No. 18.

Codes, Western Union and McNeil.

BABBITT METALS—SIX IMPORTANT

formulas. SCIENTIFIC AMERICAN SUPPLEMENT 1123. Price 10 cents. For sale by Munn & Co. and all news-dealers. Send for catalogue.

HENS ARE MONEY MAKERS

With the aid of a Genuine 1906 Pattern

STANDARD CYPHERS INCUBATOR.

Incubates More Chicks and Healthier Chicks than any other. 90 Days Trial. Big 250 page Catalogue FREE if you mention this journal and send address of two friends interested in poultry. Write nearest office.

Cyphers Incubator Co., Buffalo, Boston, Chicago, New York, Kansas City or San Francisco.

Concrete, Armored Concrete AND Concrete Building Blocks

Scientific American Supplement 1543 contains an article on Concrete, by Bryson Cunningham. The article clearly describes the proper composition and mixture of concrete and gives the results of elaborate tests.

Scientific American Supplement 1533 gives the proportion of gravel and sand to be used in concrete.

Scientific American Supplements 1507, 1508, 1509, 1570, and 1571 contain an elaborate discussion by Lieut. Henry J. Jones of the various systems of reinforcing concrete, concrete construction, and their applications. These articles constitute a splendid text book on the subject of reinforced concrete. Nothing better has been published.

Scientific American Supplement 907 contains an article by Spencer Newberry in which practical notes on the proper preparation of concrete are given.

Scientific American Supplements 1505 and 1540 present a helpful account of the making of concrete blocks by Spencer Newberry.

Scientific American Supplement 1534 gives a critical review of the engineering value of reinforced concrete.

Scientific American Supplements 1547 and 1548 give a resume in which the various systems of reinforced concrete construction are discussed and illustrated.

Scientific American Supplement 1564 contains an article by Lewis A. Hicks, in which the merits and defects of reinforced concrete are analyzed.

Scientific American Supplement 1551 contains the principles of reinforced concrete with some practical illustrations by Walter Loring Webb.

Each number of the Supplement costs 10 cents.

A set of papers containing all the articles above mentioned will be mailed for \$1.30.

Order from your newsdealer or from

MUNN & CO.

361 Broadway, New York City

Cot, invalid, M. Q. Fair, Sr.	811,492
Cotton chopper, W. H. Sutton	811,106
Cotton chopper, B. C. Butler	811,530
Couch, J. L. Heffner	810,839
Covered box, J. Bergoff	810,901
Crank disk, adjustable, L. G. Mitchell	811,426
Crate, fruit, J. Shellenberger	811,449
Crate nailing-up form, J. Shellenberger	811,448
Crate, slatted, H. N. Beckus	811,023
Crucible furnace, E. Hausmann	811,219
Cuff holder, H. C. Frank	811,210
Cultivator, J. M. Donaldson	811,133
Current machine, alternating, M. C. A. Latour	811,304
Current motor, alternating, B. G. Lamme	811,231
Cushion stuffing machine, A. L. & F. C. Roop	811,005
Cutting and measuring machine, A. P. Sweeney	811,338
Cutting mechanism, F. E. Strasburg	810,993
Cycle transmission mechanism, motor, L. G. G. Riviere	811,327
Cycles and other vehicles, cushion fork for motor, W. G. Schaeffer	811,250
Danger signal, W. C. Creveling	811,037
Decorating device, J. Gruber	811,393
Decoy, W. W. Cram	811,036
Dental and surgical lamp, C. F. Rodgers	811,442
Dental can, W. Brush, F. E. Parrish	811,270
Dental compress, N. L. Burke	811,479
Derrick and concrete mixer, combined, J. L. Parsons, Jr.	811,243
Desk pad, I. Smigel	811,334
Disinfecting compound, M. J. Manix	811,074
Disinfecting device for sink drains, A. & A. R. F. Fattenden	810,973
Display rack carriage, Catlin & McMillan	810,900
Door, J. D. Dubelman	810,923
Door bolt, E. W. Cunningham	810,918
Door lock, T. Weimer	811,013
Dredging apparatus, J. P. Cole	811,275
Dresser, chair, and trunk, combined, F. L. Bradley	811,475
Drying and conditioning machine, J. H. Lorimer	811,307
Drying and ironing apparatus, electric, G. W. Richardson	811,088
Drying kiln, E. E. Perkins	810,974
Drying machine, J. H. Lorimer	811,306
Drill holder and gage, A. La Francis	811,414
Drill press, A. E. Newton	811,317
Dye and making same, anthracene, Bally & Wolf	811,471
Earth closet, outside dry, J. R. Kooms	811,412
Educational apparatus, F. E. Parrish	811,109
Edulcorant, apparatus for producing, K. Taul	811,002
Egg carrier, J. G. Maddux	811,158
Electric controller attachment, F. Volk	811,340
Electric machine, dynamo, F. A. J. Lapoyrade	811,154
Electric machinery, dynamo, J. H. R. Mawdsley	811,312
Electric meter, Porter & Currier	811,323
Electric motor, P. Jigouso	811,405
Electromagnet, F. B. Corey	811,473
Elevator, H. S. Mackay	811,513
Elevator locking mechanism, J. S. Muckie	811,427
Elevator safety catch, A. Fisher	811,040
End cell switch, L. Lyndon	810,958
Energy, protection against reversal, L. Wilson	811,265
Engine, H. A. Stanton	811,154
Engine connecting rod, J. Sturges	810,984
Engine sparking device, Worth & Eten	811,470
Engine sparking igniter, internal combustion, A. R. Bellamy	811,122
Engine tender, traction, H. Hamann	811,030
Engraving apparatus, J. P. Stevens	810,980
Envelope, safety, H. P. Roberts	811,092
Excavating machine, C. C. Jacobs	811,431
Expansion clamp device, E. de Morier	811,193
Explosive engine, multiple piston, C. T. Hildebrandt	811,220
Extractor support, centrifugal, G. Blunder	811,383
Eyeglass case, waterproof, M. Davidson	811,487
Fabric containing haircloth, G. Goldman	810,953
Fabric containing haircloth, making, G. Goldman	810,954
Fastening device, E. A. Freeman	811,494
Feed bag, J. A. Skinner	811,450
Feeder, automatic animal, V. A. Croshier	811,038
Feeding and blending machine, C. W. Case, Jr.	811,451
Fence looms, magazine for, D. H. Hayes	811,560
Fence post, D. A. Smith	811,451
Fiber from comstals and analogous pithy plants, preparing, A. G. Manns	811,419
Fibrous materials, machine for disintegrating, cleaning and assorting, W. S. Archer	810,986
Filter, G. M. Kneuper	811,151
Fire alarm circuits, automatic non-interfering, re-peater for, F. W. Cole	810,912
Fire extinguisher, automatically operating, H. W. Hildebrandt	811,221
Fireman's protective device, F. W. Williams	811,021
Fireproof blind or curtain roller, E. H. McCloud	810,967
Fireproof metal window, R. C. Lieb	810,972
Fitting stand for, E. C. etc., J. Bair	811,208
Floor cleaning means, F. F. Anderson	811,119
Floor scraper, E. Eriksson	811,252
Floor structure, J. Erath	811,471
Flue cleaner, stove and range, W. Jaques	811,503
Flue scraper for evaporators, boilers, and the like, T. Suzuki	810,990
Fluid fuel burner, McChas & Flagler	811,078
Fluid level controlling means, J. B. Waring	811,188
Food compound and preparing the same, E. T. Williams	811,400
Foot arch supporter, F. D. Williams	811,512
Foundries, powder for dusting patterns in, E. Bruhl	811,477
Fulling machine stop-motion, D. M. Mansel	811,075
Furnace plate, E. E. Tudor	811,063
Fuse, projectile, H. C. Seddon	811,252
Game apparatus, baseball, J. P. Magenis	811,159
Game apparatus, indoor golf, M. Williams	811,347
Game table, M. M. Johnson	811,148
Garment clasp, O. Kemper	810,948
Garment fastener, W. H. Unke	811,005
Garment pads, making, G. Gouan	810,935
Garment supporter, I. J. Johnson	811,505
Gas burner, Human & Williams	811,390
Gas burner and fixture therefor, H. M. Bucknam	811,329
Gas burner inspirator and mixer, J. W. McKnight	810,908
Gas burners, electric lighter and extinguisher for, D. & C. Candi	811,200
Gas compressor, L. Sterne	811,181
Gas producer, C. Ellis	811,208
Gasket, V. J. Williams	811,000
Gate, J. R. Burkholder	811,019
Gate, I. R. Burkholder	811,371
Gear wheel cutting machine, F. M. Stam	811,336
Gearing, H. F. James	811,147
Gearing for bundling presses, J. Murray	811,164
Glass, apparatus and process for manufacturing wire, E. C. Schmertz, release	12,445
Glass cutting board, E. W. Chadwick	811,201
Glass press, W. I. Permar	811,320
Glass tanks, refractory wall for, L. J. Hoese	811,223
Grains, cleaning, H. C. Miller	810,980
Grate bar, H. B. Sperry	810,986
Greenhouses, sash lifting apparatus for, Johnston & Foley	811,506
Grinding apparatus, shears or scissors, E. F. Davis	811,202
Grinding machine, C. E. Blechschmidt	810,903
Gun cleaning device, L. D. Coleman	810,913
Gun sight, H. B. Andrus	811,297
Hammer, drop, E. S. Brett	811,368
Hammer, power, A. Bragg	810,905
Hammer, H. E. Hobbs	810,942
Hammock support, G. J. Neuman	811,166
Hat fastening device, H. Dupuis	811,043
Hat, lady's automobile, H. A. Saks	811,278
Hat tip rubbing machine, W. H. Lam	811,309
Hatband clasp, Burt & Harris	811,126
Hat fork, Anderson & Palmer	811,260
Hat fork, tilting, H. O. Sparks	810,980
Heat controlling apparatus, Clements & Hostler	811,463
Heater, W. H. & W. G. Calhoun	811,199
Heater, W. H. Brown	811,272
Heater, Hamaley & Lamerton	811,335
Heating system, hot air, W. H. Bicker	811,080

Under the
Strongest Light
THE PRUDENTIAL
Shows Strongest

THE
PRUDENTIAL
HAS THE
STRENGTH OF
GIBALTAR

THE WONDERFUL SUCCESS OF THE PRUDENTIAL

Has been due to

Careful, Conservative Management,
A Progressive Policy,
Just and Liberal Treatment of Policyholders,
Absolute Fidelity to its Trusts,
Perfect Fulfilment of Obligations.

This is the Company for you to insure in. Through its Profit-sharing Life Insurance Policy, from \$15 to \$100,000, you are afforded an opportunity to choose a plan exactly adapted in cost and benefits to your needs and conditions.

In calm or in storm Life Insurance is the one resource always certain and secure.

Write now, while you think of it, for full information, Dept. 121

The Prudential Insurance Co. of America

Incorporated as a Stock Company for the State of New Jersey

JOHN F. DRYDEN, President. Home Office, NEWARK, N. J.

The Fireless Cookstove

AND POINTS ON PURCHASING

A most valuable and interesting book on Domestic Economy by Capt. HARRY H. SHERMAN showing how to make and use a Fireless Cookstove and save seven-eighths of the fuel ordinarily used in cooking and how to purchase and properly prepare food. Bound in cloth, illustrated.

This method has been adopted by the U. S. Government for use in army camps, and the book contains many recipes and valuable instruction from the most scientific and practical cook in this country, now in the employ of the Government. Sent prepaid to any address on receipt of 25 cents.

JAPAN PUBLISHING CO., Dept. 5
American Tract Society Building, New York, N. Y.

JAGER Marine 4-Cycle Engines

Skilfully designed and well built. Single lever control, combining automatic carburetor with spark advance. Develops wide speed range and reliability under most trying conditions. Sizes 1 to 60 h. p. Send for catalogue.

CHAS. J. JAGER CO.
Cor. High and Battery March Sts.,
Boston, Mass.

THE IDEAL LAWN MOWER GRINDER

This machine will grind a lawn mower perfectly in 15 minutes, and is destined to revolutionize the whole business. Greatly improved over old models, and is now perfection. Hargest men and boys make \$50 per day using it. Nothing like it on the market. For Hand or Power use. For prices, etc., address the manufacturers.

THE ROOT BROS. CO., Plymouth, Ohio

USE GRINDSTONES? If so we can supply you. All sizes mounted and unmounted, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. Send for catalogue "T".

THE CLEVELAND STONE CO.
24 Floor, Wilshire, Cleveland, O.

A MONEY MAKER
Hollow Concrete Building Blocks, Best, Fastest, Simplest, Cheapest Machine. Fully guaranteed.

THE PETTYJOHN CO.
615 N. 6th Street, Terre Haute, Ind.

Evolution: The Master-Key

By C. W. SALEEBY, Ph.D.

Author of "The Cycle of Life," Etc.

DR. SALEEBY, whose popular articles on science in HARPER'S MAGAZINE have attracted wide attention to his work and interesting methods of presentation, here treats of evolution in the light of the enormous scientific advance that has been made during the last half-century since Herbert Spencer's "First Principles" appeared. The author holds that the truth of the law of evolution is more easily demonstrated to-day than ever before. The newest sciences—astro-physics, physical chemistry, comparative psychology, comparative ethics, etc.—each dealing with evolution in different spheres, combine to assert its validity. Furthermore, the results of modern investigations point more and more to evolution as the master-key to the solution of all phenomena. An interesting and very readable book.

Crown 8vo. Price, \$2.00 net

HARPER & BROTHERS, PUBLISHERS, NEW YORK

Wood-working Machinery

For ripping, cross-cutting, mitering, grooving, boring, scroll-sawing, edge working, mortising, for working wood in any manner. Send for catalogue.

The Seneca Falls M'g Co., 105 Water St., Seneca Falls, N. Y.

Engine and Foot Lathes

MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. BEST MATERIALS. BEST WORKMANSHIP. CATALOGUE FREE.

SEBASTIAN LATHE CO., 120 Culvert St., Cincinnati, O.

Foot and Power and Turret Lathes, Planers, Shapers, and Drill Presses

SHEPARD LATHE CO., 125 W. 32 St., Cincinnati, O.

GIANT STEAM SHOVELS

Toledo, Ohio, U.S.A.

The Vulcan Iron Works Co.

Veeder Counters

to register reciprocating movements or revolutions. Cut full size.

Booklet Free

VEEDER MFG. CO., Hartford, Conn.

Cyclometers, Odometers, Tachometers, Counters and Fine Castings.

Nickel Plate Road Agents Selling Coupons

Extremely low rate tickets on sale daily February 15 to April 1 to Pacific Coast and other points in the Far West. Tickets good on any of our trains and in tourist sleepers. For full information write A. W. BUCKLETON, D. P. A., 20 Broadway, New York City.

\$80 to \$175 Per Month

For Firemen and Brakemen, experience unnecessary. Instructions by mail at your home. High wages guaranteed. Rapid promotion. We assist you in securing a position soon as competent. Send today. Full particulars at once. Include stamp.

National Railway Training School, Inc., 438 Madison St., MINNEAPOLIS, MINN.

A. W. Tabor

Manufacture Established 1871.

Lead-Colored Plate Pencils, Rubber Bands, Erasers, Ink, Penholders, Rubbers, Water Colors, Improvers, Calculators, Rules.

Send for descriptive Circular 5.

44-60 East 23d Street, New York, N. Y.

Grand Prize, Highest Award, St. Louis, 1904.

Mustard & Company

GENERAL IMPORTERS AND COMMISSION AGENTS

Plumbing Supplies, Sinks and Sinks. The largest Hardware Machinery and Tool House in China

ON HANKING ROAD - SHANGHAI, CHINA

Automatic Water Supply

Most economical, reliable and efficient. If you have running water the Niagara engine will save 30 feet for each foot fall obtainable from springs, brooks, or rivers, delivered to any distance. Write for catalogue.

Niagara Hydraulic Engine Co., 140 Nassau St., N. Y.

French Motors for Lighting Plants

The "ARTER" is the best French motor on the market for lighting plants, boats, etc. Small, compact, simple and easy to operate. Active power, oil or gas, 2 and 4 cylinder. Great power for small engines. Easy running. Write for Illustrated Price List.

ASTER COMPANY, 1201 Broadway, NEW YORK CITY

A Loose Leaf Book

PERFECTLY Flat-Opening AND Self-Indexing

Most convenient for price books, quote books, pocket indexes, meter books, statement books and all forms of records which should be kept in convenient, accessible form. Better than any card index. These "Loose Leaf" books are bound to fall, genuine, flexible, black leather, are perfectly flat opening and sheets may be instantly inserted or removed from any page.

The following sizes sent postpaid on receipt of price:

USE	NO.	REMARKS	SIZE OF SHEET	CAPACITY OF VOLUME	COMPLETES
Van Pelt	110	0	8 1/2 x 11	50	\$0.85
Van Pelt	443	1/2	8 1/2 x 11	100	1.00
Van Pelt	617	0	8 1/2 x 11	200	1.25
Van Pelt	618	1/2	8 1/2 x 11	200	1.50
Van Pelt	712	1/2	8 1/2 x 11	200	1.75
Van Pelt	713	1/2	8 1/2 x 11	200	2.00
Van Pelt	1120	1/2	8 1/2 x 11	200	2.25

19 other sizes carried in stock.

Stock selling: Quakertown, Delaware, Dallas and Costa, Fresno, Calif., Double Entry Ledger and 2-column Price-Book Binding.

Send for sample sheet and complete catalogue of last year's line of loose-leaf devices in the world.

Wheeler & Truett Mfg. Co., 6002 Larch Ave., St. Louis

INDEX OF INVENTIONS

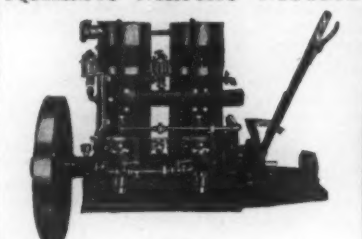
For which Letters Patent of the United States were issued for the Week Ending January 30, 1906.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acid and making same, mercury salts of	811,193
Adding and typewriting machine, combined	811,157
J. C. Lotteland	811,157
Adding device, E. C. Dilworth	811,205
Adjustable bracket, B. H. Spangenberg	811,205
Adjustable washer, J. H. Childster	811,045
Air brake, E. T. Hughes	811,064
Air brake, Sturwald & Cool	811,525
Air compressing engine, H. E. Church	811,378
Air goods, H. F. Kell	811,406
Air goods fabric, H. F. Kell	811,407
Alarm, G. A. Hill	811,061
Alloys, manufacture of nickel-copper	811,239
Mosell	811,239
Alumina, calcination of hydrated, A. R.	811,423
Feeding	811,423
Amusement apparatus, J. McCabe	811,315
Anchor, H. O. Dunn	810,924
Annunciator, W. H. Hurling	811,063
Annunciator, H. M. Olsen	811,083
Arbor, J. Cooper	811,276
Arch, B. Schneider	811,251
Auger-bit knife, F. T. Wyckoff	811,351
Automobile front axle, F. C. Miller	810,076
Automobile wheel, Wheeler & Beckoff	811,112
Automobiles, automatic air brake apparatus for, E. Kalisch	811,507
Back and chest protector, M. L. Paddock	811,167
Bag frame, B. von Elgen	810,925
Bag frame handle or strap attachment, B.	810,925
Bag handle, M. Goldsmith	811,215
Barrels, machine for making veneer stave	811,031
G. H. Brown	811,031
Bearing machine, F. A. Rapp	811,338
Bearing for splines of grinding machines	811,339
Z. B. Tucker	811,339
Bearing, scale pivot, J. A. Barclay	811,194
Bed, extension, J. H. Hanson	811,216
Bell ringer, pneumatic, J. Howe	811,400
Belt guide, K. H. Kaudsvig	811,302
Beveling machine, L. H. Rice	811,174
Bills, mechanism for feeding, tubular, E.	811,526
C. Stiefel	811,526
Blinder, loose leaf ledger, J. Graves	811,286
Blinder, temporary, J. E. Barlow	811,300
Blinders, automatic locking device for, leaf, G. T. Dalton, Jr.	810,019
Blackening machine, show, F. H. Brewster	811,030
Block, W. F. Roberts	811,440
Boat, marine, Pounderton & Bradman	811,171
Boiler fire box, steam, C. W. Hullings	811,401
Boiler tube, Whyte & Crossley	811,016
Boilers, apparatus for maintaining hot water or steam pressure in portable	811,245
C. C. Rich	811,245
Bolt coupling, king, W. W. Green	811,496
Bolt machine, J. K. Koon	811,411
Boat, hucker, J. A. McPherson	811,310
Bottle cap and cork puller, combined, H.	811,113
C. Wilson	811,113
Bottle, non-refillable, W. H. Dore	811,387
Bowling alley, F. W. Brinkmeyer	811,476
Bracket for employment on windows, lad-	811,514
ders, and projects, adjustable, C. Mills	811,514
Brake mechanism, fluid, B. T. Burchard	811,198
Breaching stay, harness, F. X. Schumaker	811,521
Brick machine, O. Nolan	811,518
Bricks and making the same, B. H. Straus	811,257
Brooder, P. Coats	811,484
Brush, fountain, G. L. Belcher	811,272
Buffing machine, J. P. Jeannette	811,504
Building block, mold, H. Nosh	810,970
Building block, mold, H. Nosh	811,080
Bulldozing machine, head for punching	810,915
Cables	810,915
Bulletin board and rack, E. W. Kingsbury	811,298
Butter cutter, B. J. Woolley	811,400
Butter, collar, C. F. Rodgers	811,443
Cab runner, J. W. Sorenson	811,453
Candy making machine, G. Pratt	811,086
Canopy, folding, P. A. Pollock	811,322
Canopy, portable, J. A. Voorhes	811,490
Car coupling, J. R. Roomey	811,329
Car coupling, J. K. Vaught	811,450
Car coupling apparatus, G. E. Kelly	811,008
Car coupling, auxiliary, Fenwick	811,434
Lecon	811,434
Car door cleat and sealing device, S. C.	810,995
Sullivan	810,995
Car door, spring, J. B. Buehler	811,091
Car dump, C. B. Clagburn	811,129
Car frame, hand, J. Donovan	811,042
Car part, E. L. Dook	811,125
Car sliding door, railway, H. A. H. H.	811,125
Car starter, Booth & Wise	811,123
Card case, W. C. Danwell	811,489
Cards, piano machine, head for punching	811,176
Jacquard, V. E. Boyle	811,305
Carpenter's brace head, A. D. Leblanc	810,922
Carriage top, C. H. Gill	811,370
Carriage, structure, F. C. Chubb	811,370
Caster, ball, Wolfe & French	811,407
Caster, ball bearing, O. C. Kulpe	811,152
Catafalque, W. J. Gabryszak	811,495
Cattle, and, F. H. H. H.	811,049
Cellulose products, treatment of matter for the manufacture of, F. L. Stewart	811,524
Cement or plastic block molding press, C.	811,423
A. Meyers	811,423
Chain, drive, W. H. Gates	811,391
Chain, extensible, E. C. Gipe	811,054
Chair attachment, reclining, M. Fan	811,138
Chair seat, V. A. Taylor	811,250
Chair tip, rocking, T. Lynch	810,957
Cigar recorder, L. H. Babu	810,896
Churn, J. G. Smith	811,102
Cigar branding machine, B. Libbey	811,071
Cigar machines, wrapper support for, O.	811,108
Tyberg	811,108
Cigarette machine, F. E. Anderson	811,118
Cleaning device, A. P. Trimm	811,101
Cleat and socket, Waite & Fralick	811,180
Clock, W. E. Porter	811,324
Clover huller feeder, H. Guderian	810,937
Clutch, J. E. Dolson	811,041
Clutch and governor, friction, C. Christian-	811,374
Clutch, friction, A. C. Monger	811,422
Clutch, self-governing, R. E. Wynn	811,352
Coal screen, E. R. Dickey	810,922
Coaling device, moving train, C. M. Miller	811,425
Coal and hat hook, H. E. Collins	811,281
Collar tray, E. J. Brandt	811,197
Collar and cuff shaper, W. M. Barnes	811,120
Collar supporter, adjustable, P. B. Reg-	811,329
nolds	811,329
Colter standard and fork attachment, mil-	811,447
ing, P. A. Shanklin	811,447
Compass, beam, A. A. Merritt	811,237
Concrete bodies, machine for molding, H.	12,444
A. Wingert	12,444
Concrete fence post, H. S. Young	811,022
Concrete mold, I. M. Emerson	811,113
Concrete, work table, L. Scheidt	811,170
Converter, G. T. Walker	811,006
Converter, B. H. Bucher	811,125
Converter, W. B. Johnson	811,149
Converter, A. W. F. Reichel	811,180
Converter, A. J. Webster	811,190
Converter, H. M. Weathers	811,462
Converter, A. J. Webster	811,462
Converter, W. C. Crowley	810,917
Conveying and elevating apparatus, A. J.	811,180
Webster	811,180
Coop, folding transportation poultry, L. D.	811,047
Fowler	811,047
Copier apparatus, F. Jaeger	811,065
Cord fastener, E. M. Comstock	811,381
Cord tension alarm, C. Brangrove	811,387
Corn extracting device, B. D. Kline	811,301
Corn husker, M. M. & E. G. Johnson	811,097
Corset, conformer, C. Munter	811,420

Reliable Marine Motors



Reliability is absolutely the first consideration in a Marine Motor.

Fay & Bowen Motors have an unequalled record for reliability in numberless endurance and heavy weather tests.

Simplicity, durability, power and flexibility. No crank required for starting.

Send for free catalogue of Reliable Motors and perfectly built boats.

Fay & Bowen Engine Company, 80 Lake Street, Geneva, N. Y., U. S. A.

For Polishing and Sharpening

35,000 "Little Wonders" in every corner of the globe talk for us. They are "homemakers." We have been in this business three years. Not so bad imitations are beginning to appear. Their claims are true but their results are limited. Don't get fooled. Initiation is the secret form of initiation, but we like you to know that it is a simple matter. **Facet Water Motor** attaches directly to regular threaded faucet or by our Universal Connection to any smooth faucet. Not a toy. **Sharpening** knives, scissors or cutlery of any description, polished and cleaned brass, nickel plate, silver or any metal surface. **Facet** makes power to operate light machinery of any kind. Useful about the home for a dozen different purposes. **Facet** includes motor, sturdy wheel, buffing and polishing wheels, cutting wheel and silver and steel polishing compound. **Complete**, ready boxed, \$1.00. Attractive booklet on request, **FREE**.

WARNER MOTOR CO., Dept. 15, Flatiron Bldg., New York

Mfrs. of Water Motors 1-16 to 10 h. p. Water Pumps and accessories

Electric Supplies and Novelties

Catalog of 300 pp. free. If it's Electric we have it.

OHIO ELECTRIC WORKS, Cleveland, O.

The World's Headquarters for Electric Novelties, Supplies, Books. We Underwrite All Want Agents.

NEW YORK SCHOOL OF AUTOMOBILE ENGINEERS

Incorporated

147 West 50th Street, New York City

Under the personal direction of

PROF. CHAS. E. LUCKE, M. E., Ph.D.

School of Engineers, Columbia University

Departments include machine tool and forge shops, assembling and test shops, and every type of motor, also laboratories completely and specially equipped to teach all component parts of automobiles.

Day and Evening Classes.

SPECIAL COURSES FOR OWNERS.

THE PANAMA CANAL IS DESCRIBED

from the engineering standpoint in **SCIENTIFIC AMERICAN SUPPLEMENT 1339**. Price 10 cents, by mail. Munn & Company, 361 Broadway, New York City, and all newsdealers.

\$250 for an Automobile

The "Success" is just what you have been waiting for. It is an automobile buggy-light, strong, powerful, speedy, safe and easy to operate. The "Success" is not an experiment. It is thoroughly practical—invented by an engineer with ten years' experience in automobile construction. Over ordinary roads it will run 100 miles on one gallon of gasoline. It's a good bill chamber—takes a 20 grade. Speed from 4 to 15 miles per hour. No complicated parts to get out of order.

Orders for Spring delivery should reach us early as orders for March shipments will tax our output facilities. Write for descriptive literature, terms, etc.

"SUCCESS" AUTOMOBILE MFG. CO.

532 De Baliviere Ave., St. Louis, Mo.

THE ARDREY VEHICLE WASHER

(Patented Aug. 15, 1905.)

With the Ardrey Vehicle Washer you can keep your Carriage, Auto, Bus or Delivery Wagon clean, without wetting your hands or clothes. Made of solid brass. Its any ordinary hose. Water constantly forcing itself through the sponge tissue constantly removing all dirt and grit. Absolutely impossible to injure the finest finish. **Proprietor: ARDREY VEHICLE WASHER CO., 181 F. Main St., Rochester, N. Y.**

THE SHOREHAM

WASHINGTON, D. C.

The Leading Fashionable Hotel

METROPOLITAN STANDARD OF EXCELLENCE. ABSOLUTELY MODERN AND HIGH CLASS IN ALL DETAIL. AMERICAN AND EUROPEAN PLAN.

JOHN T. DEVINE, PROPRIETOR

THE POSTAL TYPEWRITER CO.'S

FACTORY AT NORWALK, CONN.

is Equipped to do Experimental Work, Tool Making and Manufacturing. Inventions Developed. Very Best Work Guaranteed. Correspondence Solicited.

THE "BEST" LIGHT

SUPERIOR TO ELECTRICITY TWO CENTS A WEEK

When you are tired of the smoke, dirt, and odor of your ordinary light, get the light that is brighter than electricity or kerosene, and makes its own gas. There is only one. It's the "BEST." It's much cheaper than kerosene. It's made in over 100 beautiful styles. It's an ornament to any home, and every lamp is warranted. Just drop us a postal today and get our catalog and prices. Agents wanted everywhere. Big money in it for you to either use or sell our lamps.

THE BEST LIGHT CO., 87 E. 9th St., Camden, O.

Owners of Original Patents.

A Sterling Silver Cigar Cutter

that every smoker will be glad to own. No matter in what part of the United States you live we will mail one postpaid.

The R. S. Cigar Cutter

For One Dollar

is the handsomest and most satisfactory cutter made. Carried in vest pocket. Lasts for years. Ask your jeweler.

Send postpaid to any address on receipt of One Dollar.

F. H. DICKSON, 22 Hay's Bldg., Malden Lane, N. Y.

RELIABLE MARINE ENGINES

Reliability under all conditions is the characteristic of the "Lamb" Engines. Stems from 15 to 100 H. P. In stock. Write for catalogue.

TERRY & CO.

Managers Eastern and Foreign Branch

85 Chambers St., New York

Everything for Boat & Engine

The Benton Valveless Engine

Has no valve in either intake or exhaust. Consequently it has fewer wearing parts. It has fewer parts to get out of order. It has more power with less weight. It uses less gasoline. It is under perfect control. Runs at any speed from 1 to 40 H. P. Furnishings for fresh or salt water.

T. P. BENTON & SON

MANUFACTURERS

Front and Pearl Streets, LA CROSSE, WIS., U. S. A.

The Wonder Gasoline Motors

Something New and Up-to-date. More power for less money than any other machine on the market. No valves, gears, etc., to get out of order. Jump spark. Our 15 H. P. motor outfit is a "WINNER." Solid or reversing propeller. Our price will surprise you. Write to-day. Marine or stationary outfit to suit any requirements up to 5 H. P.

The R. M. Corwell Co., 406 E. Main St., Syracuse, N. Y.

STEAM TURBINES.—THEIR CONSTRUCTION, OPERATION AND COMMERCIAL APPLICATION. **SCIENTIFIC AMERICAN SUPPLEMENTS 1304, 1307, 1308, 1423, 1400, 1447, 1376, 1373.** The articles have all been prepared by experts in steam engineering. Price 10 cents each, by mail. Munn & Co., 361 Broadway, New York City, and all newsdealers.

Four-Cycle Motor

Simple and double cylinder. Simple and reliable. Best materials and workmanship. Not how cheap but how good. They are moderate in price. Write us. Catalogue Free. **Grand-Terris Co., Troy, N. Y.**



1st The Infant in the Nurse's Arms.

For Shakespeare's Seven Ages

That Horlick's Malted Milk is the best milk-food for the baby is proved by thousands of healthy infants everywhere. It is pure, rich milk, so modified and enriched with the extract of selected malted grains as to be easily digested by the weakest stomach. Ready at a moment's notice by simply stirring in water. No additional milk or cooking is required.

Very sustaining for nursing mothers. A healthful, invigorating food drink for everybody, from infancy to old age. A glassful taken hot before retiring induces restful sleep.

A sample, vest pocket lunch case, also booklet, giving valuable recipes, sent free, if mentioned. At all druggists.

ASK FOR HORLICK'S; others are imitations.

Horlick's Malted Milk Co.
Racine, Wis., U. S. A.
London, England Montreal, Canada



Bristol STEEL FISHING RODS

GIVE AND TAKE

They give just enough when the fish strikes, the delicate spring of the Rod hooks instantly. They take up the slack line promptly, preventing the fish from shaking loose when he rushes toward the fisherman. What the "BRISTOL" is to the ordinary rod, our Combination Rod and Handle is to the ordinary reel. It is placed in the center of the handle, forming a part of and securing a perfect balance of the whole. These are two of the desirable features of the "BRISTOL".

THE BOSTON MFG. CO., 58 Horton St., Boston, Mass.



I Will Make You Prosperous

If you are honest and ambitious write me today. No matter where you live or what your occupation has been, I will teach you the Real Estate business by mail; I will give you a Special Representative of my Company in your town; I will give you a profitable business of your own, and help you make big money at once.

Unusual opportunity for men without capital to become independent for life. Valuable book and full particulars free. Write today.

EDWIN H. HARDEN, Pres't
National Co-operative Realty Co., 604 Athenaeum Bldg., Chicago

PATENTS

Our Hand Book on Patents, Trade-Marks, etc., sent free. Patents procured through MUNN & CO. receive free notice in the SCIENTIFIC AMERICAN
MUNN & CO., 361 Broadway, N. Y.
BRANCH OFFICE: 625 F St., Washington, D.C.

Mohler & De Gress

LIGHT-WEIGHT, HIGH-SPEED AUTO-MANINE Motors



Write for Catalogue
F. A. SEITZ CO.
149-159 Frelinghuysen Avenue, Newark, N. J.

Valve, blowing engine, J. Kennedy	811,228
Valve, check, F. E. Ten Eyck	811,185
Valve, engine, T. M. Andrews	811,117
Valve, rotary, C. W. Maudslayi	811,235
Valve, tank, D. D. Casey	811,034
Vamp marking machine, J. F. Rogers	811,240
Vapometer, C. W. Hubbard	811,307
Vegetables, etc., cutting machine for, A. W. Thomas	810,908
Vehicle driving mechanism, motor, C. E. Maff	811,314
Vehicle, motor, A. Ingalls	811,403
Vehicle recorder, J. T. Whalen	811,015
Vehicle spring, pneumatic, M. M. Howard	811,296
Vehicle top arm front, C. C. Daugherty	811,039
Vehicled, foldable railway, H. Barry	811,200
Vending machine, coin controlled, J. Heinrich, et al.	811,501
Vending machine, fraud preventive mechanism for cigar, J. Heinrich, et al.	811,385
Vending machines, mechanism for feeding cigars in, J. Heinrich, et al.	811,390
Venerer drier, W. M. Schwartz	811,446
Wagon body, D. Stevens	811,104
Wagon body, C. Leavitt	811,155
Wagon, dumping coal, W. Leonard	810,953
Wagon, logging, J. L. Riddle	810,980
Warp stop-motion, T. A. B. Carver	811,373
Washer, See Adjustable washer	811,201
Washing machine, F. H. Halstead	811,444
Water closet, F. Schuh	811,444
Water closet flushing apparatus, outdoor, W. C. Griffiths	810,936
Water head gate, F. R. Giddings	811,212
Water heater, J. W. Denmead	811,368
Water purifying and regulating means, D. Cochrane	811,485
Water purifying apparatus, C. L. Kohnen	811,220
Web looping mechanism, H. F. Bechman	811,270
Web manipulating mechanism, H. F. Bechman	811,271
Weeder tooth, S. A. McNeely	811,121
Well sinking apparatus, M. T. Chapman	810,910
Wells, fishing tool for, A. W. Wolf	811,348
Whip holder, T. H. Ludewick	811,308
Winding reel, G. Pour	810,977
Windmill, E. R. Harrington	811,218
Windscreen, metal, H. M. K. Kohnen	810,982
Wire drawing device, gripping means for, H. L. Thompson	811,107
Wire receptacles, apparatus for making open-work, C. A. Smith	811,257
Wire stretcher, A. A. Smith	811,254
Wood decorating implement, R. A. Culver	811,386
Wood spoons, cores, etc., machine for roughing, H. J. Duncanson	811,281
Wooden dishes, machine for cutting, T. H. MacLean	811,004
Wrench, M. M. Howard	811,218
Wrench, B. H. Wagy	811,461

DESIGNS.

Badge, W. S. Carter	37,797
Glass sheet, F. Shuman	37,803
Lamp reflector, W. Churchill	37,798
Sign, illuminated chandelier, J. L. Dawes	37,798 to 37,802

TRADE MARKS

Automobiles and motor cars, B. A. Gramm	49,234
Beer, Lager, Dubague Brewing and Malting Co.	49,273
Boots and shoes, leather, A. L. Joslin Co.	49,180
Boots and shoes, leather, Jordan Marsh Co.	49,205
Boots and shoes, leather, J. J. Lettenmann	49,200
Brads, bindings, and trimmings, Fletcher Manufacturing Co.	49,187
Brads, skirt, Walter Stewart Co.	49,258
Brandy, John Bardenheiser Wine and Co.	49,204
Bricks and artificial stone, Florida White	49,355
Butter coloring preparations, Wells & Richards	49,205
Cabinets, kitchen, C. P. McDougall	49,213
Candy, New England Confectionery Co.	49,230
Carbon blaud (C), E. R. Taylor	49,227
Cards, playing, United States Playing Card Co.	49,255
Carrriages, buggies, wagons, and carts, Studebaker Brothers Manufacturing Co.	49,351
Catheters and bougies, Johnson & Johnson	49,283
Cement, Portland, Lehigh Portland Cement Co.	49,238
Chemical, crystalline soluble, J. M. Keil	49,206
Chlorid of lime, Leggett & Brother	49,210
Chocolate and cocoa, Knickerbocker Chocolate Co.	49,343
Chocolate drops, New England Confectionery Co.	49,294
Chocolates, Van Euden Cocoa Co.	49,363
Cigars, Abraham Strauss	49,207
Cleaning and disinfecting compound, Klein-So Pharmaceutical Co.	49,346
Coal, coke, and charcoal, Ginn Co.	49,346
Coffee berry, Milliken, Tomlinson Co.	49,346
Concrete building block making machine, Cement Machinery Co.	49,231
Confectionery, chocolate, E. Greenfield's Son & Co.	49,334
Cord, braided, Whittier Mills	49,308
Cotton duck, Mount Vernon-Woodberry Cotton Duck Co.	49,214
Cotton piece goods, Massachusetts Cotton Mills	49,211
Cotton piece goods, Indian Head Mills of Alabama	49,236
Cotton piece goods, Massachusetts Cotton Mills	49,238
Cotton piece goods, Tremont and Suffolk Mills	49,319
Crochet quilts, Union Manufacturing Co.	49,201
Deminents, Lavadora Chemical Co.	49,286
Display fixtures, Hart Manufacturing Co.	49,311
Display fixtures, Heilmann-Miller Manufacturing Co.	49,240
Dress goods, male, E. R. Taylor	49,205
Drinks, mixed, J. Jacques	49,202
Dye colors, W. Cushing & Co.	49,194
Electric fans, Goodhue Electric & Manufacturing Co.	49,251
Embroideries, T. D. Elmer & Son	49,186
Engines and pumps, hydraulic, Rife Hyd. Engine Manufacturing Co.	49,206
Engines, gasoline and marine, H. Keidel	49,286
Fabric, imitation of Persian lamb, J. & J. Johnson	49,272
Fabric, waterproof, Standard Patent Co.	49,254
Fabrics, drapery and upholstery, Eddystone Manufacturing Co.	49,245
Fabrics, drapery and upholstery textile, Eddystone Manufacturing Co.	49,245
Fabrics, printed and dyed cotton textile, Eddystone Manufacturing Co.	49,302
Fabrics, printed and dyed textile, Eddystone Manufacturing Co.	49,302
Flour, self-raising or pancake, Topeka Milling Co.	49,300
Flour, wheat, H. Hamill Co.	49,350
Flour, wheat, S. Hamill Co.	49,350
Gin, Francis Goudy Distilling Co.	49,248
Glassware, pressed or blown, A. H. Heisey & Co.	49,335
Grease, lubricating, Philadelphia Grease Manufacturing Co.	49,316
Horns, Pike Manufacturing Co.	49,328
Home supporters, C. J. Higley	49,277
Hosiery, American Stocking Co.	49,298
Hydroxylite compound, Cassella Color Co.	49,183
Inks and writing fluids, writing, Diamond Ink Co.	49,322
Inks, printing, Jaquocks Printing Ink Co.	49,312
Insect poison, Jenkins Brothers	49,205
Jellies, jelly powders, jams, and preserves, Francis H. Leggett & Co.	49,323
Lamps, electric arc, Jandus Electric Co.	49,250
Lathes, Patterson, Gottfried & Hunter	49,347
Lead, white, National Lead Co.	49,291
Lead, white, T. B. Brothers	49,321
Leggings or overalls, Columbia Overalls and Legging Co.	49,229
Limbs and embrocations, W. F. Young	49,322
Locks and keys, Russell & Wright	49,349
Loag cloth, Sherman, Held & Co.	49,241

HAYNES

The Car of Many Exclusive Features

The Haynes has many exclusive features that assure for it a wonderfully low maintenance and up-keep expense. In a 5,000 mile trip, made in early winter, from Kokomo, Ind., to New York and Boston via Albany, returning over the Allegheny Mountains by the National Road, the repair expense was but \$1.50. Roller-bearings throughout, make the loss of power between the motors and rear tires less than 10 per cent., and account for the ease with which the car went up the longest and steepest grades in crossing the mountains. The Haynes exclusively has roller-bearing engines: a Master Clutch with no wearable surfaces, which takes hold without jerking; a transmission that positively prevents burring and stripping of gears; and a roller pinion and rear axle that overcome every objection to shaft drive cars. Other exclusive Haynes features are given in our new catalogue. For prompt attention address Desk L.I.

"The Car the Repairman Seldom Sees"
HAYNES AUTOMOBILE COMPANY
KOKOMO, INDIANA
Chicago, 1420 Michigan Ave. New York, 1715 Broadway
MEMBERS A. L. A. M.



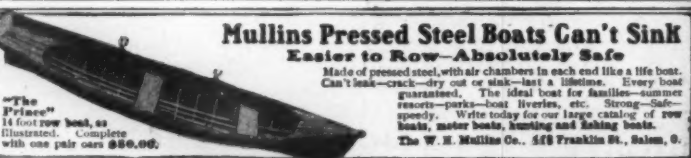
Model "B" Four-Cylinder Touring Car
Vertical roller-bearing engine. Cylinders cast separately 8 1/2 x 6 inches, 50 H. P. An exclusive transmission that absolutely prevents stripping of gears. Positive cooling system. Individual and special lubrication. Master Clutch has metal faces and takes hold without jerking. Shaft drive. Exclusive universal joints that prevent wear on pins. Spruett and Roller Pinion and perfect Rear Axle, all exclusive. Roller bearings throughout. 100-inch wheel base, 64-inch track, seating five people. Four to 60 miles an hour on high gear. Weight 2,500 pounds. Price \$5,200, f.o.b. Kokomo. Full equipment.

Model "D" Four-Cylinder Touring Car
Cylinders cast in pairs 4 1/2 x 5 in., 35 to 30 H. P. Transmission, cooling system, lubrication, master clutch, shaft drive, universal joints, spruett, roller pinion and roller bearings and body same as on Model "B". 87-inch wheel base. 44-inch track. Seating three people. Four to 40 miles an hour on high gear. Price \$4,750, f.o.b. Kokomo. Full equipment.

The Ready Draughting Instrument

carried in the pocket performs every service, anywhere, that can be accomplished by your T-square, Compass and Triangles, or Protractor, all of which are too bulky to be carried about. You know what this means when you are "off on a job" and want to lay out a certain piece of work without delay attendant to reaching your regular working table. The illustration is 3/4 actual size, and a description is necessary to show the uses of the Ready Draughting Instrument as a Rule, Square or Scale. Angles of any degree are found by the protractor and circles by use of the compass at 1/4, and the numerous holes are for reception of your pencil point in the smaller; the larger to show progress of the line drawn, particularly where there are of a circle meets any given point. With our Ready Draughting Instrument there is no delay in adjustment of compass points to find centers, and angles of any degree are determined with quickness and dispatch. The price of this time and labor saver is but \$30., and your money returned if not entirely satisfactory.

READY MFG. CO.
Rochester, N. Y., U.S.A.



Mullins Pressed Steel Boats Can't Sink

Easier to Row—Absolutely Safe

Made of pressed steel, with air chambers in each end like a life boat. Can't leak—can't dry out or sink—lasts lifetime. Every boat guaranteed. The ideal boat for families—summer resorts—parks—boat houses, etc. Strong—Safe—specify. Write today for our large catalog and see boats, motor boats, hunting and fishing boats. The W. H. Mullins Co., 448 Franklin St., Salem, O.

Opaque Projector

A Magic Lantern for showing Diagrams, Prints, Cuts, Illustrations in Books, Movies and Spectacles on the Screen without previous preparation, brilliantly lighted and in natural colors. Send for circular. Williams, Brown & Earle Dept. 6, 315 Chestnut St., Philadelphia, Pa.

YOUR HOUSE, APARTMENT, STORE, BANK OR OFFICE

Thoroughly Cleaned In One Day.

We will send our cleaner to your address, put a hose through the window and actually pump out all the germ-laden dust and dirt without taking up a carpet or upsetting your household or business arrangements. Our wagon, with the cleaner, stands for Progressiveness.

BUILDINGS Cleaned by the Vacuum Cleaner ARE MORE HEALTHFUL.

Tell us what you want done, and we will send full particulars and estimate.

Telephone 2884 Chelsea.

VACUUM CLEANER CO.

130 W. 18th St., New York.

MAXIMUM POWER—MINIMUM COST

If you use a pump for beer, lard, acids, starch, paint, glue, molasses, mash, tanner's liquor, cottonseed oil or fluids, hot or cold, thick or thin you want to get the TABER ROTARY PUMP which does the most work at the least expense. Simply constructed. Can be run at any desired speed. Perfectly interchangeable. Needs no skilled workman. Durable guaranteed. Catalogue free. TABER PUMP CO., 32 Wells St., Buffalo, N. Y., U. S. A.

THE EUREKA CLIP

The most useful article ever invented for the purpose. Indispensable to Lawyers, Editors, Students, Bankers, Insurance Companies and business men generally. Book marker and paper clip. Does not mutilate the paper. Can be used repeatedly. In boxes of 100 for sale. To be had of all bookellers, stationers and notion dealers, or by mail, free, manufactured by Cassady Safety Pin Co., Box 121, Bloomfield, N. J.

KLIP-KLIP

"DUO" MANICURE-CIGAR CUTTER

A blade for each purpose. 25c By Mail. Worth its weight in gold.

A Perfect manicure. A Sanitary Cigar Cutter.

Klip-Klip "Duo" (two in one) has a sharp steel clip, file and cleaner. Keeps the nails in perfect condition. Also a separate blade which cuts cigars quick and clean. It is sanitary. Physicians say everyone should use his own cigar cutter. It is light, compact and handsomely finished and sells at sight. Two combined for one price. At all dealers or mailed upon receipt of 25c. The "original" German silver Klip-Klip (manicure only)—same price. Your money back if you want it.

MANUFACTURED ONLY BY THE KLIP-KLIP COMPANY
650 Chelsea Ave., S., Rochester, N. Y.

THE "LEADER."

14 H. P. Gasoline Auto-Marine Engine
Built like a watch. Beautifully finished. Accurately constructed. Light, strong, reliable, and powerful in operation. Suitable for launch from 12 to 18 feet in length. Price complete, \$15 net, no discount. Thoroughly guaranteed. Perfect Speed Control. Complete descriptive Catalogue upon application. Manufactured by
CLAUDE SINTZ,
202 S. Front St., Grand Rapids, Mich.

THE B. F. BARNES 14-INCH DRILL

is adapted for work from 1 1/2 inch to 14 inch. A strong, substantial, well built drill. Plain lever or power feed as desired. We build a full line of Drills. All sizes furnished in Gangs. Also have 9-inch and 11-inch Screw Cutting Lathes, and a 34x12-inch Wet Tool Grinder. Catalog 50 request.
B. F. BARNES COMPANY, Rockford, Ill.
European Branch, 149 Queen Victoria St., London, E.C.



HAIR

Our Guarantee Backed by the Bank

We will send you by prepaid express, an Evans Vacuum Cap, to use sixty days, and if you do not cultivate a sufficient growth of hair within this time to convince you that this method is effective, simply notify the Jefferson Bank of St. Louis, and they will return the price of the Cap to you.

The Cap is used a few minutes each day, and even one application produces a pleasant, tingling sensation, which denotes the presence of new life in the scalp and which cannot be obtained by any other means. Where the life principle has not become extinct, this method of stimulation will usually develop a growth of hair about an inch in length, within the trial period.

A series of letters from a number of people, giving their experience with the Evans Vacuum Cap, appears in this month's "Metropolitan" and "Everybody's" magazine, and we will send copy of these letters, together with an illustrated book, to anyone interested.

We have no agents or traveling representatives. All orders for our invention come through the Jefferson Bank and each customer is protected by guarantee issued by the Bank. For further information address

EVANS VACUUM CAP CO.
212 Fullerton Bldg., St. Louis, Mo.

GEMS of ART

A Book containing 24 of the most extraordinary photographs ever shown in one publication. The Artist's Dream Realized. Size of Book 6x9 inches, all full page pictures. Sent prepaid for 25c.

Address
THE WHITE CITY ART CO.
352 Dearborn St., Chicago, Ill.

The "Kant-Klog" Sprayer

Something New. Gets twice results with same labor and fluid. All sizes. Flat or round spray from same nozzle. For trees, vines, vegetables, disinfecting, wagons, fire, etc., etc.

Agents Wanted.
Circular free.

Rochester Spray Pump Co., 20 East Ave., Rochester, N. Y.

WARREN'S Walrus Roofing

MANUFACTURED BY
WARREN CHEMICAL & MFG. CO.
18 Battery Place, New York

EAST ST. LOUIS, ILL.

—AS A—

Manufacturing Center

offers more and better facilities than any other city in the United States. As proof of this, it has the proud record of having four factories in the past five years—more than any other city in the West.

The factories now located here employ upward of 30,000 men, entailing an annual pay-roll of over \$15,000,000. The annual output of these factories is upwards of 60,000 car loads.

What it Means to You

As a manufacturer, two things are of vital importance to you, viz.: Cost of Production and Markets.

East St. Louis offers:

A cheaper cost of production, by reason of cheap fuel and water, lower freight rates and freedom from labor troubles.

A home market of 30,000,000 consumers within a radius of 500 miles.

East St. Louis wants more factories—more lines of business of every description—and is making exceptional inducements to secure them. We will aid you in locating, and if you locate now you can get an exemption from city taxes and a steaming license for a term of years. It will pay you to investigate this. Write for full particulars. Desk B.

East St. Louis

Real Estate Exchange

East St. Louis, Illinois

60 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &c.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. HARRISON on Patents sent free. Oldest agency for securing patents. Patents taken through Munn & Co. receive special notice, without charge, in the

Scientific American

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, \$5 a year; four months, \$1. Sold by all newsdealers.
MUNN & CO., 361 Broadway, New York
Branch Office, 625 F St., Washington, D. C.

Lozenges and throat tablets, bronchial, Frog	49,271
In Your Throat Co.	49,181
Lye and potash, Brockman Manufacturing Co.	49,300
Macaroni, spaghetti and vermicelli, Woodcock	49,300
Magazine, monthly, Horsholmer Soap Co.	49,190, 49,200
Malines and mousselines, T. Thiedemann & Son	49,318
Medical preparation for genito-urinary diseases, A. F. Kalkhoff	49,284
Medicinal compound, J. F. Cholewinski	49,327
Medicinal preparation, Leslie E. Keeler	49,315
Medicines for diseases of the vagina, W. H. Holliday	49,336
Membranes, Johnson & Johnson	49,281
Mica for lubricating purposes, United States Mica Mining and Milling Co.	49,330
Motor cycles, W. F. Remppis	49,348
Newspaper, weekly, Billboard Publishing Co.	49,226
Oiled clothing, J. H. Rowe Co.	49,278
Oil, lubricating, Galena-Signal Oil Co.	49,274
Ointment, F. Watson	49,305
Ointments and lotions, Lechelet Preparation Co.	49,253
Overcoats, coats, vests, and trousers, Marx & Haas Clothing Co.	49,287
Overalls, coats, vests, trousers, and pants, F. B. Q. Clothing Co.	49,308
Paper, blotting, Eaton-Dikeman Co.	49,243
Paper, drawing, Keuffel & Esser Co.	49,252
Paper, writing, Fox River Paper Co.	49,187
Plasters, Johnson & Johnson	49,279
Plows, listers, and harrows, Emerson Manufacturing Co.	49,233
Polishes for wood, metal, marble, and glass, C. H. Smith & Co.	49,242
Printing machines, web perfecting, Goss Printing Press Co.	49,310
Razors, Challenge Cutlery Corporation	49,326
Remedy for certain named diseases, Dr. M. F. Groves & Son & Co.	49,185
Remedy for coughs, colds, croup, and consumption, C. B. Munford	49,215
Remedy for pain in crumion form, J. D. McLaughlin	49,286
Roofing and waterproofing, National Coal Tar Co.	49,290
Scrapers, earth, Kilbourne & Jacobs Manufacturing Co.	49,313
Screw drivers, Toner & Brown Co.	49,360
Screws, metal, Rabbitt Brothers	49,324
Seed, grass and field, W. G. Scarlett	49,225
Sewing machines and parts thereof, Illinois Sewing Machine Co.	49,337
Sewing machines and parts thereof, Union Special Machine Co.	49,361
Sharpening stones, Pike Paper Co.	49,187
Shirts, collars, and cuffs, Fellows & Co.	49,233
Shoe dressing, Wolff Chemical Co.	49,200
Shoes made of leather and of canvas, V. K. & A. H. Jones Co.	49,204
Shoes, women's leather, A. H. Berry Shoe Co.	49,170
Shotguns, rifles, and revolvers, H. Keid	49,342
Shovels, spades, and shoveling, and Spill	49,207
Supplies Hardware Co.	49,235
Silver, Henry E. Frankenberg Co.	49,235
Silver-plated flat ware, hollow ware, and tableware, Wm. A. Rogers	49,200
Silver-plated hollow ware, International Silver Co.	49,338
Soap, laundry, Maple Leaf Works	49,244
Soap, tar, Pioneer Tar Soap Co.	49,317
Stoves and ranges, Gem City Stove Co.	49,356
Stoves, ranges, furnaces, and boilers, Barstow Stove Co.	49,290
Suitings for men and boys, T. Oakes & Co.	49,240
Surgical dressings, Johnson & Johnson	49,282
Talking machine records, Victor Talking Machine Co.	49,364
Thread, cotton, Clark Mill-End Spool Cotton Co.	49,298
Threads, chenille, tinsel, and arranges, Henry E. Frankenberg Co.	49,275
Tinware, second-hand, and spading, H. Hudson's Pharmacy	49,221
Toilets and specdies, Fritz & Wichl	49,191
Tooth washes and powders, Puritt Bros Co.	49,219
Trimmings and brids, Henry E. Frankenberg Co.	49,191
Trousers, fasteners for, and handbands of, Catch On Chain Manufacturing Co.	49,230
Trucks or low wheel wagons, farm, Deere & Wheeler Co.	49,329
Trunks, Welton Gleason	49,246
Tube expanders, Ajax Manufacturing Co.	49,323
Uric acid solvent, Dr. Haskins Co.	49,290
Valves and water valves, steam, Fairbanks Co.	49,353
Vehicle spring seats and cushions, J. L. Clark	49,325
Vehicles, horse drawn, Studebaker Brothers Manufacturing Co.	49,352
Washing powders, Citrus Soap Co.	49,328
Watches and clocks, R. H. Ingersoll & Bro.	49,357
Whisky, Brand Brothers	49,188
Whisky, J. & A. Freiberg	49,189
Whisky, Glaeser & Baren Distilling and Importing Co.	49,191
Whisky, L. W. Levy & Co.	49,208
Whisky, J. Pohlman & Co.	49,216
Whisky, E. J. Quinn	49,220
Whisky, Raphael & Zengschmidt	49,222
Whisky, H. Ross & Co.	49,224
Whisky, Edgewood Distilling Co.	49,247
Whisky, Weldeman Co.	49,259
Whisky, Union Wholesale Liquor Co.	49,263
Yarns, woolen, worsted, and mohair, Henry E. Frankenberg Co.	49,194, 49,195

LABELS

"American Cabinet," for cigars, R. Steinecke	12,635
"Brilliant Cigar Co.'s Caswell," for cigars	12,634
"Columbia Oat Flakes," for oat flakes, Albers Brothers Milling Co.	12,642
"Columbia Wheat Flakes," for wheat flakes, Albers Brothers Milling Co.	12,644
"Dextro," for stationery, M. Shure	12,651
"Ea Kay Whiskey," for whiskey, W. P. Shade	12,638
"Hass's Delight," for cigars, H. Hass	12,636
"Krakjak," for biscuits, Union Biscuit Co.	12,645
"La Cigale French Bath Sachet," for toilet articles, F. O'Brien	12,647
"Magnon," for beer, Williams Brothers Co.	12,639
"Patrician Alabastine," for shoe dressing, Faunce & Spinney	12,650
"Patrician Satin Glose Dressing," for shoe dressing, Faunce & Spinney	12,649
"Penna Dela," for cigars, T. Krieg	12,653
"Rosa de Farina," for cigars, Schmidt & Co.	12,657
"Sauer's Pure Concentrated Extract," for flavoring extracts, C. F. Sauer Co.	12,646
"Violet Self Raising Buckwheat Flour," for buckwheat flour, Albers Brothers Milling Co.	12,641
"Violet Self Raising Pancake Flour," for pancake flour, Albers Brothers Milling Co.	12,640
"Violet Wheat," for wheat flakes, Albers Brothers Milling Co.	12,643
"Vomiting for Diphtheria, Croup, &c.," for medicine, Keller Brothers	12,648

PRINTS

"Coming Thro' the Rye," for whisky, Savage Manufacturing Co.	1,566
"Don't Discharge the Cook," for flour, Washburn-Crosby Co.	1,567
"Prize Medal Brand Garments," for underwear, Salt Lake Knitings Works	1,568
"Putnam Boots," for boots, H. J. Putnam	1,568
"Ugh! Heap Canned White Man," for talking machines, E. G. McClure	1,570

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

Surveyors

during to fit themselves for later paying positions should send for 200-page handbook (F.R.E.) describing our Surveying course and cover to others, including Civil, Electrical, Mechanical and Steam Engineering, Architecture, Mechanical Drawing, Structural Drafting (Telephony), Textiles, etc.

American School of Correspondence, Chicago, Ill.

Signs, Boxes, Souvenirs & Novelties

of Aluminum in any number or design. Lithographed metal signs, boxes, jars, etc. Enameled iron signs of all colors. Designs, estimates and catalogues.

S. J. Altmann Co., 120 Nassau St., N. Y.

M. E. Walsh, N. Y.

LET US BE YOUR FACTORY

WRITE FOR ESTIMATE ON ANY ARTICLE YOU WANT MANUFACTURED

STAMPINGS, MODELS, EXPERIMENTAL WORK

WRITE FOR FREE BOOKLET

THE GLOBE MACHINE & STAMPING CO.

970 Hamilton St., Cleveland, O.

ICE MACHINES

Corlies Engine, Brewer and Bottlers' Machinery. THE VILTER MFG. CO., 800 Clinton St., Milwaukee, Wis.

MODELS & EXPERIMENTAL WORK

Inventions developed. Special Machinery. E. V. BAILLARD, 24 Frankfort Street, New York.

RUBBER

Expert Manufacturers Fine Jobbing Work

PARKER, STEARNS & SUTTON, 238-239 South St., New York

EXPERIMENTAL WORK

Scientifically and accurately executed. Models and small machinery perfected. STEVENS & VOLKMER, 61 Fulton Street, Telephone 525 John.

MODELS

dies, boxes, metal stampings, patent articles, novelties, manufactured and sold. Printing on aluminum. U. S. Novelty Co., Lily Dale, N. Y.

THE NATIONAL MODEL WORKS

Best equipped Model Works in the United States. 85-87 Fifth Avenue, Chicago.

DRYING MACHINES

S. E. WORRELL, Hannibal, Mo.

Special Machinery designed and built to order.

G. M. MAYER, M.E., 1311 Monmouth Bl., Chicago, Ill.

Telegraphy

Circular free. Wonderful automatic teacher, 5 styles \$1 up. OMNIGRAPH CO., Dept. 35, 39 Cortlandt St., New York.

Magical Apparatus

Grand Book Catalogue. Over 700 engravings. So. Parlor Tricks Catalogue, free.

MAZINKA & CO., Mfrs., 285 Sixth Ave., New York.

NOVELTIES & PATENTED ARTICLES

MANUFACTURED BY CONTRACT FINISHING DIV. SPECIAL MACHINERY. E. KONIGSLOW & SAMPSON & THE WORKS, CHICAGO, ILL.

Experimental & Model Work

City & advice free. Wm. Gardam & Son, 45-51 Ross St., N. Y.

MASON'S NEW PAT. WHIP HOIST

For Outrigger boats. Faster than Elevators, and hoists direct from teams. Saves handling at less expense. Manufactured by VOLNEY W. MASON & CO., Inc., Providence, R. I. U. S. A.

WELL DRILLING

Over 75 sizes and styles, for drilling either deep or shallow wells in any kind of soil or rock. Mounted on wheels or on rails. With engines or horse power. Strong, simple and durable. Any mechanical man operates them easily. Send for catalogue.

WILLIAMS BROS., Ithaca, N. Y.

"STANDARD"

Two-Speed Automatic Coaster Brake Hub

Makes wheeling a delight, eliminates the drag, does not waste money on experiments when you can buy a perfect attachment all in one hub. Our little booklet tells all about it and is mailed free. Write to-day.

THE STANDARD COMPANY

Terrington, Conn.

DULUTH

THE COMMERCIAL GATEWAY TO THE GREAT NORTHWEST

—AN EMPIRE IN EXTENT.

The location of the city, at the head of navigation, in the center of a continent, 1,400 miles from the sea, gives it unequalled facilities (through 8,000 miles of railways centering here) as a natural distributing-point for a great and prosperous section.

Nature has provided a magnificent harbor with 40 miles of frontage, and its floating commerce is exceeded by only three ports in the entire world.

The manufacture of pig-iron here, on a large scale, is now an assured success, with an increasing demand for the product.

The development of 200,000 hydraulic electric horse-power, 30,000 being now under contract, will attract large manufacturers of many different lines, for which the West will be a growing market.

We have cheap power, cheap coal, cheap gas, cheap iron, cheap raw material of woods, in vast quantities, with unequalled transportation facilities in every direction.

Duluth is an attractive and progressive city, unique in many ways, and a delightful and healthful place of residence.

Duluth invites correspondence with manufacturers who would consider a Western location, where all conditions are most favorable for success.

Address **A. H. COMSTOCK, Chairman**

Industrial Committee

COMMERCIAL CLUB OF DULUTH

GOVERNMENT POSITIONS

50,000 Appointments

were made to Civil Service places during the past year. Excellent opportunities for young people. Each year we instruct by mail hundreds of persons who pass these examinations and receive appointments to life positions at \$600 to \$1200 a year. There is a great demand for Patent Office eligibles. Write for our Civil Service Announcement, containing dates, places for holding examinations, and questions recently used by the Civil Service Commission.

COLUMBIAN CORRESPONDENCE COLLEGE, Washington, D. C.

PROPOSALS will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 o'clock A. M., February 20, 1906, and publicly opened immediately thereafter, to furnish at the Navy Yard, New York, N. Y., a quantity of machine tools, etc., comprising saw bench, planer, tubular boiler, pumps, and steam winches. Applications for proposals should refer to Schedule 243. Blank proposals will be furnished upon application to the Navy Pay Office, New York, N. Y., or to the Bureau, H. H. HARRIS, Paymaster-General, U. S. N. 1-7-05.

MACHINERY AND SPECIAL PARTS

new devices developed; successful experimental work done; specially skilled labor; good facilities; good value for your money.

J. H. ENGLISHMAN MFG. CO.

near Penn. Depot, Jersey City

\$5 WATER MOTORS \$1

BOLGIANO'S LITTLE GIANT

BOLGIANO MOTOR CO., Baltimore, Md.

INVENTORS

We manufacture METAL SPECIALTIES of all kinds, to order. Largest equipment; lowest prices. Send sample or FREE model for low estimate and best expert advice.

THE LITTLE TOOL CO., Dept. A, Cincinnati, O.

LEARN WATCHMAKING

We teach thoroughly in so many months as it formerly took years. Does away with tedious apprenticeship. Money earned while studying. Positions secured. Send for Catalogue.

ST. LOUIS WATCHMAKING SCHOOL, St. Louis, Mo.

BIG OPPORTUNITIES

In making Concrete Products, Miraclo Blocks, Sewer Tiles, Brick and Hollow Tile. Information free. Catalogue A. L. MIRACLO PRESSED STONE CO., Minneapolis, Minn.

TYPEWRITERS

All the Standard Machines SOLD or RENTED ANYWHERE at \$10 to \$15 per week. IMPROVED APPLIED on principle of typewriter examination. Write for "Cost." TYPEWRITER EXHIBITION, 208 LaSalle Street, Chicago.

OPPORTUNITIES in ENGINEERING WORK

Booklet published by Engineering Co-operative Association gives opportunities, salaries and promotion for Engineering Professionals. Mailed for twenty five cents. Earl Lewis, Secretary, 184 5th St., Brooklyn, N. Y.

WELL DRILLING

Over 75 sizes and styles, for drilling either deep or shallow wells in any kind of soil or rock. Mounted on wheels or on rails. With engines or horse power. Strong, simple and durable. Any mechanical man operates them easily. Send for catalogue.

WILLIAMS BROS., Ithaca, N. Y.

"STANDARD"

Two-Speed Automatic Coaster Brake Hub

Makes wheeling a delight, eliminates the drag, does not waste money on experiments when you can buy a perfect attachment all in one hub. Our little booklet tells all about it and is mailed free. Write to-day.

THE STANDARD COMPANY

Terrington, Conn.

New York Belting and Packing Co.

LIMITED

Manufacturers of High Grade

Rubber Belting

Diaphragms, Dredging Sleeves, Emery Wheels; Air Brake, Steam, Suction and Garden Hose, etc., Mats, Mating, Interlocking Rubber Tiling. Also manufacturers of moulded and special rubber goods of every description.

Write for catalogue.

91-93 Chambers St., New York



CHARTER

Stationaries, Portables, Motors, Pumps, Sewing and Boat Outlets, Combined with Dynamometers.
Guaranteed, U.S.A. Kerosene.
Send for Catalogue.
Horse Power Needs.
CHARTER GAS ENGINE CO., Box 148, STERLING, ILL.

Scales
All varieties at lowest prices. Best Railroad Truck and Warehouse Stock Scales made. Also 1000 useful articles, including Saws, Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE CO., Chicago, Ill.

What Is Daus' Tip-Top?

TO PROVE that Daus' "Tip-Top" is the best and simplest device for making 100 copies from pen-writers and 50 copies from typewritten originals, we will give complete typewriter, cap and pen, without deposit, on ten (10) days' trial.
Price \$7.50 less \$5 Net
trade discount of 85% per cent, or \$5.12 per cent.

The Police A. R. Daus Typewriter Co., Box 114, 111 John St., New York

CRUDE ASBESTOS

DIRECT FROM MINES
PREPARED ASBESTOS FIBRE
for Manufacturers use
R. H. MARTIN,
OFFICE, ST. PAUL BUILDING,
220 S. W. way, New York.

Bausch & Lomb Microscopes

This is an invitation to send for our illustrated catalog of Microscopes if you are interested in best instruments for the least money, those that are used in the leading laboratories everywhere and by individual workers who know the best.

Bausch & Lomb Optical Co.
MANUFACTURERS
ROCHESTER, N. Y.
NEW YORK CHICAGO BOSTON
SAN FRANCISCO FRANKFURT A-M GERMANY

LUFKIN TAPES AND RULES

ARE THE BEST.
For sale everywhere. Send for Catalog No. 16.
LUFKIN RULE CO.
Saginaw, Mich., U.S.A.
New York and London.

WHAT ARE YOUR EYES WORTH?

Save the strain upon them by reading at night only by the light of our special Lamp that aids, not injures, the eyes. Our No. 66 EASY CHAIR LAMP can be raised or lowered at pleasure, has adjustable hood. Finished in polished brass and enameled copper. Fully guaranteed. Send, express paid, for \$95.00. Refund if not liked.
THE CARPIS CO., La Crosse, Wis., U.S.A.

TOOL KNOWLEDGE CHEAP

In fact you can have it free! This out represents our new Tool Catalogue No. 22. It is cloth-bound and contains 900 pages all about Tools. Full descriptions and thousands of illustrations. Sent post-paid on receipt of \$1.00 which is refunded on your first purchase from us of \$5.00 or over.

MONTOOMERY & CO.
165 Fulton St., N. Y. City

PARALLEL CHISELS & CLAMPS
15 to 21 South Clinton Street.

Machinists!
Tool Makers!
Pattern Makers!
Electricians!
Draughtsmen!
Everybody!

FREE!

A New, Scientific, yet Simple Device for Taking Measurements in the Wrist-Coatha Combination Gauge.
Now offered for the first time in these interesting

A TOOL CHEST IN YOUR VEST POCKET

WHEREVER YOU EVER, when called upon to perform some mechanical work, confronted by almost unnumberable difficulties because you did not have the right kind of tool to take measurements? The W. G. Combination Gauge combines: an Outside Caliper, an Inside Caliper, a Divider, a Straight Edge, an Angle Edge, a Depth Gauge, a Try Square, a Center Square, an Angle Protractor, a Center Gauge and many others too numerous to mention. Takes all measurements within its scope, accurately and quickly.
Made of superior steel by expert mechanics, no time or expense being spared to insure absolute accuracy. The mechanic and practical man will find use for it under all circumstances. Comes enclosed in a neat leatherette case with metal trimmings so as to be conveniently carried in the pocket. Here is a

ALWAYS
AT HAND,
NEVER
IN THE WAY

SPECIAL OFFER

READ IT

MODERN MACHINERY
We want to increase the Subscription List to our Monthly Journal. The foundation of civilization rests on inventions of new machinery. To keep abreast of mechanical progress should be the aim of every intelligent man. Our publication keeps you informed, and it is written so all can understand it, and the best illustrated of its class. **MODERN MACHINERY** costs \$1.00 a year. We want to get you started reading this major regularly and therefore make you this offer. Send us your subscription at once, enclosing \$1.00, and we will mail you **MODERN MACHINERY** every month for one year and a **WET-GOETHE COMBINATION GAUGE FREE** at once. If not just as represented, send the gauge right back and we will refund your money. Don't delay accepting this proposition; write today. Remember, your dollar back tomorrow if dissatisfied.

Modern Machinery Publishing Company,

Suite 915 Security Building, Chicago

GAS ENGINE GENERATOR

STEADY LIGHT FROM AN ORDINARY GAS OR GASOLINE ENGINE
Not a makeshift, but a specially designed machine with bearings amply heavy to support balance wheel without a third bearing. Write for Bulletin 152
ROCHESTER ELECTRIC MOTOR CO.
10-12 Frank St., ROCHESTER, N. Y.

ROAD BUILDING MACHINERY

ACME ROAD MACHINERY CO., FRANKFORD, N. Y. U.S.A.

STEAM USERS

Rainbow Packing

The original and only genuine red sheet packing.

The only effective and most economical flange packing in existence.

Can't blow Rainbow out.

For steam, air, hot or cold water, acid and ammonia joints.

Beware of imitations.

Look for the trade mark—the word Rainbow in a diamond in black, three rows of which extend the full length of each roll.

Manufactured exclusively by
PEERLESS RUBBER MFG. CO.
16 Warren St., New York

TO FILL CONKLIN'S SELF-FILLING PEN

Simply dip in the ink, press with the thumb, and the CONKLIN PEN is filled and ready for instant use. It is simple, convenient, efficient, with no complex mechanism and nothing to get out of order.
The elastic ink reservoir is compressed by the pressure bar under the thumb, and, when released, instantly draws in the ink through the feed channels at the point. The quickly adjusted lock-ring prevents ink from being forced out again. Feeds regularly until the last drop of ink in reservoir is used. Always responds without kick or balk. Cleans itself as easily as it is filled. Fully guaranteed.

If your dealer does not handle the CONKLIN PEN, let us make you our Special Offer to Purchase Pen Direct. Full information, with illustrated catalogue, sent upon request. Sold by dealers everywhere.

THE CONKLIN PEN CO.
514, 516, 518 Jefferson Ave., Toledo, Ohio.
88 Reade St., New York.
1280 Curtis St., Denver.
414 Market St., San Francisco.
American Agencies, Ltd., 25 Shoe Lane, Fleet St., London, E. C. 4, Eng. Rae, Mann & Gilbert, 47 Market St., Melbourne, Aust.



cently equipped with our Fire Escape. Write for circulars and full particulars.
COVERT FIRE ESCAPE COMPANY, Troy, N. Y.

The recent fire at the "West Hotel," Minneapolis, proves that these so-called Fire Proof buildings are not Panic or Smoke proof, the loss of life and injury to guests being appalling.

This illustrates one side of the "Devlin House," Plattsburgh, N. Y., recently

JUST SEND ME ONE DOLLAR

and I will ship C. O. D. to any railroad station in the U. S. this fine Willard Steel Range. Anyone can say they have the best range in the world, but I will furnish the evidence and leave the verdict to you. After you examine this range, if you are satisfied in every way, pay Agent \$14.00 and freight, and you become the possessor of the best range in the world for the money. The range has six 8-inch lids; 18-inch oven; 15-gallon reservoir; large warming closet; top cooking service 30x34 ins. Guaranteed to reach you in perfect order. Shipping weight, 400 lbs. Thousands in use and every one of them giving satisfaction. Write for full description and testimonials.

WM. G. WILLARD
No. 13 WILLARD BUILDING
336-220 CHESTNUT STREET ST. LOUIS, MO

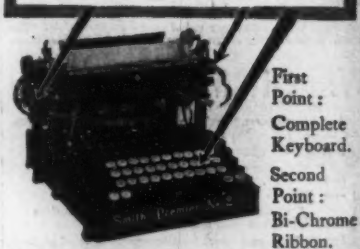
SOLARS FOR MOTOR CARS

Don't be "Penny wise and pound foolish" and equip a really good car with "just so good" lamps. The "Night Eyes" are the most important equipment of your car. Moral: use **SOLAR LAMPS**.
The Solar line is so complete that you can select from them the correct lamps for any style of car.
Our complete catalogue will tell you all about the different patterns and prices. Yours for the asking.
BADGER BRASS MFG. CO. Kenosha, Wis.
New York Office, 11 Warren Street

Good Points in the Smith Premier

Third Point: The quiet carriage of the Smith Premier typewriter saves the nerves of the whole office and adds materially to the life of the machine.

THE SMITH PREMIER TYPEWRITER CO.
SYRACUSE, N. Y.
Branch Stores Everywhere.



First Point: Complete Keyboard.
Second Point: Bi-Chrome Ribbon.

THE LOCKE ADDER

Only \$5.00
The Modern Business Necessity
CAPACITY 999,999.000
The famous Calculating Machine. Absolutely independent of the world's coin. Rapid, accurate, simple, durable. The model, original copper finish, \$14.00; enameled other finish, with case, \$10.00. Send for Free Circular and Special Offer. Agents wanted. E. C. LOCKE MFG CO., 35 Walnut St., Keosauqua, Iowa.

NAIL HOLDER AND SET

THE Nail can be driven where the hand cannot reach. Don't spend your fingers. 25 cents buys it all. Order to-day. Catalogue No. 11 B of Free Tools free.
THE L. S. STARNETT CO., Athol, Mass.

Not even the suspicion of a blemish on the surface that has been polished by this Polishing Lathe. Complete with full stock, ten rest, face plate, saw arbor, and three-jaw chuck milled bed, plus a swing, hollow spindle, 12-inch bed, polishing, grinding, and kindred operations. A useful machine in many places. Price \$7.50 each. Catalogue free.

GOODSELL-PRAATT COMPANY, Greenfield, Mass.